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EDITORIAL NOTES.

The Proposed Joint Bill.

IT must be generally conceded that, in view of the deliberate judgment of the Joint Committee to whom the Houses of Parliament referred the question for final decision as to whether or not the gas industry should be deprived of its power to deal in residual products, it is not right that the gas undertakings operating at the present time under the imposed disability should for any period remain tied to it. To-day their position in this respect is totally different from that of all other gas undertakings. They could not, however hard pressed they might be, however fine an opportunity was presented to them for the disposal of (say) a quantity of coke or tar in excess of their own resources, make up their requirements by any transaction with a neighbouring undertaking, and yet that is secondary to the larger question of free markets, the evidence as to the value of which accrues instead of diminishing. That the restriction should be removed where it has been imposed is the natural sequel to the inquiry by, and report of, the Joint Committee, which report declares that it is not politic that there should be any statutory limitation upon markets in this respect. The Parliamentary Authorities would not have been willing to countenance, nor Parliament to consent to, the appointment of the Joint Committee for a specific purpose if they were not prepared to accept, fully and immediately, its findings. To think otherwise would be to question the reason of Parliament for making the reference they did. On these considerations, the simplest course of procedure is the promotion of a Joint Bill to relieve the gas undertakings that had the restriction placed upon them; for it is not to the common nor to the individual interest that the restriction should remain in any Act for a period longer than it may take to remove it by parliamentary process.

The meeting of parties interested—company and local authority—to consider the question of a Joint Bill was held last Thursday; Mr. H. E. Jones, the Chairman of the Gas Companies' Protection Association, presiding. The proceedings were of a private nature; but the text of the resolution passed is published in other columns. Very properly the Chairman gave credit to the Association for the leading part taken by them, in conjunction with the Institution of Gas Engineers and the Association of Municipal Corporations, in contesting this important issue for the gas industry; and he also praised the energetic and comprehensive manner in which Messrs. R. W. Cooper and Sons handled the case for them. Those present also placed on record their deep sense of satisfaction with the report of the Joint Committee, and expressed the view that it is desirable that statutory relief from the restriction should be obtained. That being so, it was conceded on all sides that a Joint Bill, in which all who wished to do so with the interdict upon them could join, would be the best mode of proceeding. While some present were not able positively to bind their Boards and Committees without consultation, all could say that their Boards and Committees felt the injustice of the restriction; and therefore there was no doubt as to their adhesion to any acceptable scheme for a Joint Bill. But there was a distinct feeling, regarding the promotion of a "late" Joint Bill, that there should be consultation with the Parliamentary Authorities; and Messrs. Cooper were instructed to confer with them, as well as to forward a copy of the resolution to the Association of Municipal Corporations with the view to joint action. We should imagine that the Parliamentary Authorities will be very willing to offer facilities for the passing of a Joint Bill, so that there may be a final settlement as quickly as possible, instead of allowing the matter to drag on to further length. It is better for all that an end should be made of the question early; and the countenance of a "late" Joint Bill by the Parliamentary Authorities should be an inducement to all concerned to join in its promotion. The Parliamentary Authorities will remember that the promoters upon whom the restriction was imposed have been put to expense—a large expense in some cases—in contesting the question, in which they were the defending and not the aggressive parties; and it is therefore only right that relief should be given quickly, and that facilities should be afforded for the prompt passing of an amending Bill.

There the matter rests for the present. As soon as the Parliamentary Agents have taken counsel with the Authorities, a further meeting will be convened of the companies and local authorities concerned, of whom there are about two dozen. Until then, we hope that no one will definitely come to any determination other than that, if the Parliamentary Authorities encourage the promotion of a "late" Bill, each undertaking will do its part to bring about the final and proper conclusion to this campaign. It would be well if there were no echoes of the matter after such a Bill received the Royal Assent.

No Substantial Reason Left.

WHEN the scheme for the British Commercial Gas Association was originally introduced to the gas industry, several reasons were advanced by a considerable proportion of the gas undertakings of the United Kingdom why they then preferred not to join the new organization. But there were, as a matter of fact, very few gas administrations that had such conclusive convictions on the subject that they announced a determination not to become at any time parties to the work of the Association. Many—very many of those who then held aloof—decided that they would watch and ascertain the nature of the operations of the new body before coming to any settled decision. Of course, every abstention of this kind has made it so much the more difficult for the workers to prove that the organization is an effective and indispensable piece of mechanism in the industry's commercial prosperity. If all undertakings had adopted the wait-and-see policy, there would have been no organization capable of demonstrating its capacity for usefulness. Therefore those administrations that adopted the line of caution at the expense of those who were willing and enterprising enough to make the trial are the double debtors of the latter; for they have gained the experience of the last nine months, and they are also joint-beneficiaries (though non-contributors) in the good resulting from the keeping in the public eye the claims of gas as an agent of large utility. Irrespective of this, however, it is certainly now the duty of those who advanced reasons for not joining at the inception of the Association to return again to the subject, and ask themselves whether the answer to those reasons has not been evolved from time and work. If it has, and the answer is good and sufficient, then the obligation is plain to at once give adherence and support to the Association.

In an article published in the "Bulletin" of the Association this month, and reproduced in our issue last week, "F. W. G." deals with the reasons that were originally advanced; and, in view of the active and effective work of the Association, he claims that the way is now open to those to join who at first doubted both the expediency and the potentiality of a publicity agency of this kind for the gas industry. The nine months' work has, we think, proved beyond question that in the Association we have an organization that is essential to the well-being of the gas industry, with a constitution healthy and strong, and a power for good that can be developed far beyond present imagination. It has not taken nine months for several of the originally hesitating gas administrations of the British Isles to come to a determination favourable to membership. The first issue of the "Bulletin" showed a roll of 223 subscribing undertakings; the latest issue, one of 290. That is excellent. What has made undertakings that at first refrained since enter the ranks of the Association? The administrations of the undertakings that are still outside will find it difficult to

frame any other explanation than that of a conviction as to its value. When we consider the commercial status of the majority of these concerns, we are not prepared to say that their administrations in this particular matter have beguiled themselves. We will not pass in review all the points raised in the article of "F.W.G." as to the advertising work of the Association, nor as to its having become the repository for the best of everything in the nature of literature and illustration for the local publicity needs of its subscribers, or regarding the watchfulness of its officers, so far as is humanly possible, upon the Press of the country to see that any inaccuracy assailing the interests of gas is at once corrected.

The matter may be looked at from other points of view. We are standing now with nine months' work done; and we glance back over that work. The first thing that strikes us is that the publicity propaganda has been of a character that never was covered, nor ever could be covered, by purely local operation, which does not comprehend all that is really required. The Association has opened up new ground in the commercial work of the industry; and its moving spirits are so full of energy and belief that they desire to deal with more of the virgin soil that the organization is best fitted to cultivate. That it fills a place never occupied before, and that that place is one of proved usefulness, is a sufficient reason for its existence. Local publicity has its limitations; a wider publicity reaches many that the local publicity cannot touch. In our "comings and goings" day by day during the greater part of the last nine months, we have found advertisements and paragraphs relating to gas in the most unexpected places. The constant unlooked-for reminders in the general literature of the country cannot fail to produce new currents of influence that must work up the intelligence of the country to a still greater appreciation of the value in many directions of the industry's primary commodity. A good commercial system makes use of every possible legitimate vehicle for gaining the eye, the ear, and the favour of the public; and there is no reason why the commercial publicity and educational system of the gas industry should not be on the highest plane of development. This brings us to the question of subscription. "F. W. G." makes a strong point when he says that it is not what a gas undertaking can afford to spend on publicity, but what it will profit it to spend. That is a point which will especially appeal to the engineers of the industry, who know what it often profits their undertakings to spend in scrapping plant and adopting improvements in order to achieve economies that far exceed the charges incurred. Of this we are also confident, that the existence of the Association has been the means of cultivating a greater respect for the gas industry on the part of its competitors and of men in many public places. It has adopted a policy that is not offensive to competitors, but merely defensive when there is any attempt at maligning the interests of the industry. There is also the further point that this is the only organization of the gas industry that incorporates in its membership all the commercial interests of the industry. There is, in fact, no other purely commercial gas organization.

On these grounds, as well as those stated by "F. W. G.," we ask whether the time has not arrived when the reasons originally advanced by many gas undertakings have proved to be without substance, and when these undertakings can link themselves up to one of the most effective organizations the industry has ever possessed. Fresh invitations to enrol themselves have been issued to the non-subscribing undertakings with a make above a certain minimum line; and we should now like to see the total at the foot of the roll of subscribers quickly made up to the figure representing the statutory gas concerns of the United Kingdom, instead of the 290 which is the total to-day.

Domestic Heating Considerations.

THE subject of the cost of domestic heating always brings into the polemical arena a number of people who have made certain crude cost tests to their own satisfaction, with what types of fires or heaters no one knows but themselves. The results of the tests usually show that the form of heating for which the individual has preference is the most economical of all. It is not stated whether the fires experimented with are supposed to be the most efficient of their kind; the figures usually suggest that the only efficient stove is that which the controversialist wishes to support in the argument, and that all the others are more or less antiquities. The correspondence that has been proceeding in "The Times," as a result of the recent Cantor Lectures by Mr. Charles R. Darling, F.I.C., conveys this; and it also indicates the omission of several other material considerations that bear upon the question of rational domestic heating. It would be indiscreet, however unfair it is, for those favourable to other systems of heating not to take in their comparisons the continuous consumptions of gas-fires which obviously are not of the more modern economical type, and which we often suspect are of those grate adaptations that part with a wasteful proportion of the heat up the chimney, and so render much less efficiency than the modern embodiments of domestic gas heating. The continuous burning of all the competing fires for the purpose of obtaining relative costs makes no distinction between the means of heating that offers the facilities of prompt lighting and extinguishing at will and regulation of temperatures, and therefore are economic in that they need only be used as and when the temperature demands. This is a point that is pressed upon the view of "The Times" controversialists by Mr. F. W. Goodenough; and it is a matter that would be found to have much weight in the domestic economy if a year's comparative costs were available between a properly-used gas-fire and a coal or other fire lighted and maintained all thrcugh the day when there was in the morning a touch of freshness about the atmosphere.

The published comparisons are altogether vitiated by the neglect of such considerations, as well as of the points of convenience, labour-saving, and capacity for maintaining and adjusting temperatures. In short, published heating-cost comparisons have an altogether too unscientific basis. There are questions of very much higher importance than these general ones. There is such a thing as quality in heating, and the various means of heating occupy different platforms in regard to healthful and sanitary conditions. Certain correspondents, for instance, make much of the economy of the anthracite stove—a stove which, once in use, is kept burning through the heating season whether or not its heat is only wanted intermittently. It has nothing about it of the ventilating virtues of open fires (the gas-fire included). It cannot claim like them to give a large proportion of its heat in the radiant form; but it can boast that it bakes the air in its immediate vicinity, sets up convection currents, and produces an oppressive atmosphere where it is used. This is a condition that largely discounts the much advertised lower cost per day. To pay even a low price for the promotion of uncomfortable conditions does not appeal to us. There is a great deal more in this question of domestic heating than the mere one of relative cost for a continuous run; and yet we cannot appraise the value of some of these considerations in more than general terms. For this reason, unless the inquiry was of a very comprehensive nature, and took in the scientific aspects as well as that of cost, we should not see much value in Mr. Darling's suggestion as to a reference of the subject of heating to a Committee of the Society of Arts.

Chemical Control of Manufacture.

"WE must certainly keep pace with everything that makes "for more accurate control of our manufacture." That was one of the opening passages in Mr. P. C. Balcon's paper on "Technical Gas Analysis," read before the Midland Junior Gas Association on Saturday; and the sentence is one with very full meaning for gas manufacturers. It is in the accurate control, as we have insisted so frequently, of manufacture to day that we look mainly for further economies, and preservation from loss. New plant alone is not an assurance that the best possible results will be obtained, and, if obtained for a period, that they will be maintained unless there is absolute control. We have seen over and over again the efficiency of gas plant gradually depreciated where it might have been appreciated solely owing either to the bent of operators to become lax, or to an utter unconsciousness as to the real source of falling away in efficiency. From this experience alone, we are wholly with Mr. Balcon that gas manufacturers must keep pace with everything that makes for more accurate control, and we would add especially in these days when the commercial position of the industry depends so much upon the quality of its staple product, and the giving to the consumer the largest possible quantity of combustible gas in the volume that he purchases. But after reading Mr. Balcon's paper, certain uncomfortable reflections remain, bearing upon the existence

of several opposing factors to the realizing of perfect control. We think that this is becoming more and more recognized; and no harm will be done—in fact, good must ensue—by frequently examining and discussing defects, and stimulating work for their eradication. There have been signs in the shape of material improvement that a great deal of work of this nature is proceeding, and the Birmingham gas laboratories, through Dr. Davidson and other members of the staff, including Mr. Balcon himself, have made their contribution to this end.

In connection with gas analyses, the question first arises, Is the apparatus that is almost universally in use the best for obtaining the accuracy that is essential? A negative answer will not raise any storm of protest. For if we take the Hempel and Orsat apparatus—the two best known, and curiously still perhaps most used—their disadvantages have long been recognized by those who do not use apparatus of the kind in a perfunctory manner. The Hempel apparatus is not capable of being read with comparative accuracy, and it lacks portability; the Orsat apparatus is portable and self-contained, but it has its inaccuracies and its disadvantages. But as our pages have borne witness, and as Mr. Balcon again testifies, improving work has proceeded, and is still proceeding. This is the first point at which gas manufacturers must seek to obtain greater accuracy in the control of their manufacture—that is, by placing in the hands of the laboratory staff the best available instruments for performing their work. It is no good having a chemist and assistants who are paragons in careful operation, if they are handicapped by instruments of an untrustworthy nature, or that are so unwieldy or so designed as to cause difficulty in manipulation, and thus contribute to inexact results. The author of the paper did not profess to go over the fairly large ground of new apparatus that is, or claims to be, an improvement on the older forms which have such large vogue in laboratories—more because of their long establishment and use there than from any other cause. But he called attention to improvements that have been designed mainly at Birmingham by Dr. Davidson, in co-operation with other members of the staff and which improved apparatus has suppressed certain of the disadvantages of other systems. These are described, and interest will be found in the various appliances, the details of which will be closely examined by the chemical competents in other laboratories.

There are many hints in the paper as to how to obtain fairly reliable results; but the loopholes for error are found in every direction. There is the question of the confining medium. If very accurate analyses are required, mercury must be used, though the apparatus is bulky and cumbersome. It was a distinct act of retrogression from accuracy when water was substituted for mercury, considering its absorbent character—in, of course, varied degree—for the constituent gases; and there are gases of which it would be ridiculous to attempt to make a correct assessment with water used as the confining medium. But apparently Mr. Balcon, while acknowledging that water imposes its limitations in this connection, holds that, if care is taken in carrying out analyses over water, using the apparatus and methods for which he has preference, they should be strictly comparable, and, in fact, may easily compare well with analyses made over mercury. In dealing with the question of exact analysis, Mr. Balcon pronounces in favour of the constant volume apparatus rather than constant pressure apparatus. Preference too is given to the Bone and Wheeler apparatus. But here again, "for certain reasons," it has been found necessary at Birmingham to modify it. However, with all the possible accuracy of improved apparatus, this and the results achieved stand at a disadvantage if the operator is not an individual who exercises scrupulous care; and scrupulous care is not always in evidence in published analyses. The necessity, too, for great care in the matter of the selection and use of reagents is a point that must be insisted upon. Again, importance is laid upon the accurate estimation of nitrogen to the gas maker, and we may add to the consumer. The chemical staff at Birmingham lay so much stress upon this that they make an estimation of nitrogen direct for each analysis carried out; and, if the figure obtained by difference is not confirmed, the analysis is repeated. There is no excuse now for continuing to patronize, or rather to rely wholly upon, the old method of estimating nitrogen by difference, which gives scope for so much error.

There is a great deal of detail in the paper, which will claim consideration from those engaged in laboratory practice. But the most important thing about the contribution for gas manufacturers, apart from chemists, is the lesson that the best and most reliable chemical apparatus and the men who exercise the maximum care in their work are what are needed if economies (which include savings) are to be gained and maintained, and the very best levels of efficiency protected, in the processes of gas manufacture.

Lowestoft Ratepayers and Electricity Users.

The Lowestoft Corporation are one of those bodies who have decided to supply electricity for cooking purposes at 1d. per unit. We have been looking around to see if any justification can be found for this; and there has been utter failure. It cannot be expected that the ratepayers of Lowestoft should understand the wonderful laws that govern, or are supposed to govern, the charges for electricity—laws that are at every turn violated by those professing belief in them, on the score of expediency. To put the matter so that the ratepayers can understand one phase of it—this for our present purpose is the important phase—the electricians contend that it is cheaper to supply a given quantity of electrical energy to a long-hour user than to a short-hour user. That is to say, supposing a man requires 100 units a day, if his demand is spread over twelve hours he can be supplied cheaper than the man who wants 100 units in an hour, and his requirements then cease for the day. With this in mind, the ratepayers of Lowestoft will have some difficulty in reconciling the charge of 1d. per unit for cooking with the charges made for other purposes.

Where is the Justification?

We believe that the charge per unit for lighting at Lowestoft is 5½d. per unit, or thereabouts; for power, a charge is made of 2d. and 1½d. per unit; for public lighting, 2·34d., and for traction supply, 1·75d. The working costs per unit (without capital expenses), according to the last statistics available, come to 1·45d. The intelligent ratepayer will be hard put to it to ascertain how the Corporation, in view of these charges for other purposes, justify the price of 1d. per unit for a purpose that represents a short-hour use; and, if there was any extensive demand, this would fall at about the same periods during the day. It is the abuse, in electricity supply, of commercial principles (as instanced in this case of cooking) that causes such losses as Lowestoft has experienced, and which, according to the proceedings at the last Local Government Board inquiry, has meant the dipping into the ratepayers' pockets for £8078, besides paying for an expensive system of public lighting. On the same occasion, the Inspector told the Corporation representatives that it seemed to him that the former were proposing to sink a lot of money in public lighting, and were not going to get anything out of it. That is a very common electrical proceeding.

Cooking at One Penny per Unit.

The people of Lowestoft have been saturated with the usual twaddle regarding the cheapness of electricity for cooking purposes. It is as cheap, it has been stated there, as cooking by gas at 2s. 6d. per 1000 cubic feet. Gas is not sold at 2s. 6d. per 1000 cubic feet in Lowestoft. But take the heating value of a cubic foot of Lowestoft gas at 500 B.Th.U., a penny will purchase 11,500 B.Th.U., compared with the electricians' claim of 3440 B.Th.U. per unit of electricity. So that the householders will see that, to get an equivalent heat from electricity as from a pennyworth of Lowestoft gas, about 3½ units of electricity must be used. The glamour that the electricians try to cast over this cookery business will not stand the test of real practical experience. In culinary operations, it is not only heat for baking, but for boiling, grilling, frying, &c., that is required; and the electricians keep themselves as far distant as possible from divulging what this means. At the Tricity Restaurant coke is being used for water heating; and water pre-heated by this means is run through the electric water-boiling appliances for tea making, and so forth.

Other Considerations.

This shows that the whole range of cooking cannot be done so economically or so cheaply as by gas. If there was the economy that is claimed in electric cooking, there would be no

need to supply at 1d. per unit in competition with Lowestoft gas, while electricity for all other purposes is supplied at higher prices. It is well for householders, before committing themselves upon the representation regarding the point of economy, to look very narrowly into the question as to why electricity for cooking is supplied at such a low price compared with the supply for other purposes. With 1d. per unit and a higher price for other purposes, separate house wiring and meter are necessary. The consumer must pay for these; the Corporation cannot afford to do so out of the 1d. per unit. An electric outfit costs more than a gas-oven; and repairs are also more expensive. As to the question of reliability, there is no comparison; and the breakdown of the electric supply or the cooker is not a thing to be looked upon with composure. At the Tricity Restaurant a gas-oven is installed as a stand-by to the electrical equipment. There are more things for Lowestoft householders to consider in connection with this matter than are found in the flippancy of most electric cooking advocates.

Government Department Waste.

It seems that in the Government Labour Exchanges, expense is no object in the pursuit of the fad to have electric lighting. The matter was dealt with in last week's issue in an article headed "Government Officials and Gas Lighting." Since then we have come across a remarkable instance of gross waste in this connection. In a town where the Labour Exchange is being transferred to new premises, a local gas-fitter received instructions—mark this!—only in the early part of December, to remove the old and faulty gas-piping, and to instal new iron piping throughout the premises. This was done; and a new 30-light gas-meter was provided and fixed. At the beginning of this month, instructions were received to remove the gas-meter, and to strip the place of the about four-week old gas piping. A firm of electricians were soon in possession installing the electric light. All this change has been proceeding while the building is being renovated. The attitude of the Government Department of which we complained last week is so inexplicable, and so unjust to the large rate and tax paying and labour-employing gas industry, that the matter ought not to be allowed to remain uninvestigated by the industry's representatives. Under the circumstances, reasons and justification for the preference should certainly be forthcoming from the Government officials, if reasons and justification have any real existence.

The Finances of a Great City.

Some idea of the amount of work connected with the administration of the affairs of a flourishing business community at the present day may be gathered from a study of the "Blue Book" of the City of Birmingham, which, on this particular occasion, extends to about 600 pages. Birmingham has grown, and its financial responsibilities have grown with it. The original area of the borough, the City Treasurer tells us, was 8420 acres; but it has from time to time been added to, until the most recent extension scheme (by which Aston Manor, Erdington, the greater part of King's Norton and Northfield, Yardley, and Handsworth were included) has brought the total area of the city up to 43,537 acres. At March, 1912, the rateable value was £4,344,434; while the population for that year is estimated at 850,947. As to the huge financial transactions, it is seen that the total income of the city for the twelve months ending March last was no less than £4,009,455, and the expenditure £3,856,619. Thus there was a balance of income in excess of expenditure of £152,836. There was a capital outlay during the year of £594,249; while the gross amount of capital that had been expended up to the end of the period dealt with reached a figure of £25,364,920. The balance of outlay on capital account remaining at that date to be provided for was £18,653,288; but, of course, a very large proportion of this debt was on account of reproductive undertakings—in all some £12,600,000. By far the largest profit earners of the trading undertakings are the Gas Department and the tramways. The water supply, on the other hand, owing to the big capital expenditure that has had to be incurred, shows a substantial loss. Electricity is well on the right side.

Petroleum Find and Police Court Proceedings.

It is a somewhat curious coincidence that, within a very few days of the issue of the annual report by the Chief Inspector of Mines, news should have been published of a strike of petroleum in Nottinghamshire. What the Chief Inspector had to report was that, though petroleum was not absolutely non-existent in Great Britain, since 1906 none had been obtained. At the present stage, of course, it might be very easy to over-estimate the importance of the latest "find," but further developments will be keenly watched; for a good petroleum supply in this country would be a boon indeed. It is said that the oil is of good quality, and that its extent is to be properly investigated. By another coincidence, we are reminded that, though petroleum may not have been obtained during recent years in Great Britain, the magic word has nevertheless been assiduously pressed into service; for on the very day on which "The Times" announced the strike of oil in Nottinghamshire, Edmund Eaton and certain of his colleagues appeared at the Tower Bridge Police Court on a batch of summonses concerning the publication of certain booklets and circulars without an imprint. Inasmuch as this matter is still *sub judice*, there is no intention of commenting upon it here; but it may be mentioned that the case has arisen out of a circular dealing with the affairs of the South of England Natural Gas and Petroleum Company, Limited, the comments upon which in "Truth" were reproduced in the "JOURNAL" for Dec. 17, p. 919.

PERSONAL.

The Blackburn Town Council have appointed Mr. G. W. CLAYTON, Water-Works Superintendent, to fill the vacancy caused by the death of Mr. Joseph Wilson.

Upon leaving Windsor, where he had been Manager of the sewage works for many years, Mr. A. SAINTY was presented with a cigarette case, suitably inscribed, by the staff. Mr. Sainty is now Works Manager at the Slough Water-Works.

Mr. HORACE LONG, the Secretary and Accountant of the Redhill Gas Company, was made the recipient, on the occasion of his marriage, which took place recently in London, of a number of choice and valuable presents from the Directors and Manager, and a handsome afternoon tea service from the office staff.

The "Journal für Gasbeleuchtung" announces that Mr. A. J. VAN EYNDHOVEN, the Chief Chemist at the Berlin works of the Imperial Continental Gas Association, has been created a Knight of the Order of Orange-Nassau by Her Majesty the Queen of Holland. Mr. van Eyndhoven enjoys a distinguished position in the Dutch colony in Berlin—being now its recognized Chairman.

Sir HENRY ROSCOE celebrated his eightieth birthday last Tuesday at his country house, Woodcote Lodge, West Horseley. His former students and friends having decided to commemorate the occasion by the presentation of his bust to the Chemical Society of London, as a tribute of appreciation of his long lifework, a representative deputation visited him on the above-named day to convey to him their congratulations, and acquaint him with their proposal. Among the deputation was Professor Smithells.

Before leaving Cambridge to take up his duties as Resident Engineer at the Enfield Gas-Works, the employees presented Mr. R. WARDELL with a silver tea service and a framed photograph of the Company's cricket team, of which he was Captain. The presentation was made at a smoking concert held in the recreation-room on the works; and, judging from the number of officials and employees present, and the enthusiasm which punctuated the remarks of the Engineer (Mr. J. W. Auchterlonie), it must have been very gratifying to the recipient.

A municipal vacancy having occurred in the Rowditch Ward, Derby, by the elevation of the Mayor (Mr. W. G. Wilkins) to the aldermanic bench, Mr. J. FERGUSON BELL, the Engineer and Manager of the Derby Gas Company, has offered himself as a candidate in the Conservative interest. He addressed a meeting of his supporters last Wednesday, and had a very cordial reception. In addition to his professional work at Derby, Mr. Bell takes considerable interest in local affairs. He is a Governor of the Girls' High School, a member of the Society for the Extension of University Teaching, and a co-opted member of the Corporation Free Library, Museum, and Arts Committee.

At the offices of the Rickmansworth and Uxbridge Valley Water Company on the 1st inst., a presentation was made by the officers and staff to Mr. and Mrs. J. D. ROPER, on the retirement of the former from the management of the Company, after some twenty-five years' service. The Secretary (Mr. L. B. Linnett), in making the presentation, which took the form of a handsome china cabinet, expressed the esteem and regard in which Mr. Roper was held by himself and all who had been associated with him in the affairs of the Company. Mr. Roper, on behalf of himself and Mrs. Roper, thanked all his friends in the Company for their beautiful gift, and for the kind thoughts and good fellowship by which it was accompanied. Mrs. Roper, in a graceful little speech, also acknowledged the gift.

OBITUARY.

The death occurred last Sunday week, at his residence at Forest Hill, after a long and painful illness, of Mr. JOHN GOODSON, the founder of the firm of Messrs. Goodson and Co., the makers of the patent governors and burners bearing their name. Since the failure of the firm two years ago, the business has been carried on by Mr. James Watkins, of Portsmouth, with the assistance, as regards practical knowledge, of the deceased and his son, Mr. Sidney J. Goodson. The funeral took place on Thursday at the Ladywell Cemetery.

The death took place on Christmas morning of Mr. JOHN G. O'SULLIVAN, the City Surveyor of Dublin, who also held the offices of City and Water-Works Engineer. Deceased had been about twenty-two years in the service of the Corporation. He was responsible for the completion and maintenance of the large supplementary reservoir at Roundwood (Co. Wicklow), and for the plans of a second reservoir which is not yet completed. Mr. O'Sullivan was highly esteemed by his professional brethren, and was very popular with all classes among the citizens of Dublin.

The death occurred on the 3rd inst. of Mr. W. J. FULLER, who for some ten years occupied the position of Engineer and Manager of the Bournemouth Gas and Water Company. He resigned, owing to ill-health, in June, 1900, and was succeeded by Mr. Harold W. Woodall. Mr. Fuller was elected a member of the old South-West of England District Association of Gas Managers in 1892, on the occasion of the visit of the Association to Bournemouth during Mr. Irving's presidency; and he passed into the Southern District Association when the two organizations amalgamated. He did not, however, remain a member after his connection with the Bournemouth Company ceased. He was a Fellow of the Institute of Chemistry, and before becoming associated with the gas industry he practised as an analytical chemist.

The Dessau Vertical-Retort Patents Sustained.

It has been pretty generally known in England that a case was being tried in Germany that called in question the validity of certain of the patents taken out by Dr. Bueb, of Berlin, under which the Dessau system of vertical retorts is constructed and worked. After hearings in the Lower Court, the appeal came on for hearing, on Friday, in the Leipzig Reichsgericht [the Supreme Court]; and the judgment pronounced was entirely in favour of Dr. Bueb. An esteemed correspondent, writing from Berlin on Saturday, says: "Dr. Bueb has obtained, in this last instance, a complete victory over Pintsch [who was the other party to the action], and the validity of the German master-patent regarding Dessau verticals is now finally established."

Petroleum in England.—According to "The Times," a colliery syndicate has for some three years been conducting boring operations at Kelham, a mile or two from Newark; and after the coal had been proved the borehole was carried below the level of the coal measures. The result of this further boring, it is stated, has been the discovery of a thick band of sandstone charged with crude petroleum, which rises in the borehole against a head of water. Samples of the oil have been submitted to analysis and pronounced to be of excellent quality, containing a high percentage of hydrocarbons, and thus of special value for fuel purposes. A report on the discovery has been made by Sir Boverton Redwood, who declares that "there need be no hesitation in regarding the oil at Kelham as a true normal petroleum, indigenous to the rock in which it occurs, and possibly filling the pores of the sandstone as far as the band extends." The right of working over a large area has been secured; and a syndicate is to be formed to sink oil wells in various parts of the estate.

Corrosion of Water-Mains.—A recent number of the "Journal of the Society of Chemical Industry" contains some interesting particulars on this subject furnished to a German publication by Herr R. Krzizan. A portion of a cast-iron main which had been in use for twenty years suddenly became defective. It had been asphalted inside and out, but the corrosion went right through. A number of conical holes were scattered irregularly over the surface, and were surrounded by graphite-like material containing particles of metallic iron. A complete analysis of this material showed that it had the following percentage composition: Metallic iron, 5·98; ferric oxide and hydroxide, 34·09; ferrous phosphate, 9·63; ferrous silicate, 37·16; ferrous sulphate, 0·47; total carbon, 11·42; sulphur, 0·097; manganese, 1·362; copper, 0·296. There was nothing in the water that passed through the pipe to account for this formation. The clay in which the pipe lay contained crystals of gypsum distributed irregularly in it. The corrosion is attributed to local currents set up by contact between the graphite particles and the iron in the presence of a solution of calcium sulphate at the points round the pipe where the crystals of gypsum were contained in the clay.

THE RESTRICTED RESIDUALS POWERS.

Question of Promoting an Amending Joint Bill.

A MEETING was held on Thursday afternoon at the Westminster Palace Hotel, Victoria Street, S.W., of representatives of gas authorities upon whom the restriction as to dealing with residual products was imposed in Acts or Provisional Orders promoted during the current session of Parliament, for the purpose of considering the advisability of the promoting of a Joint Bill by these authorities for the purpose of obtaining statutory relief from the restriction.

The gathering was presided over by Mr. Harry E. Jones, the Chairman of the Gas Companies' Protection Association, who explained the position of affairs; and after the matter had been fully discussed, a resolution was moved and agreed to by the meeting in the following terms:

"That this meeting of the promoters of Gas Acts and Orders in the session of 1912, who were placed under a restriction as to dealing in residual products, hereby records its sense of deep satisfaction with the report of the Select Joint Committee on Gas Authorities (Residual Products), and that it is desirable that statutory relief from the restriction imposed in the cases above referred to be obtained.

"That Messrs. R. W. Cooper and Sons be instructed to confer with the House authorities in reference to the promotion of a 'late' Bill in the ensuing session for or otherwise obtaining the statutory relief aforesaid.

"That Messrs. R. W. Cooper and Sons do convene another meeting of the gas authorities to whom the notice of this meeting was sent as soon as possible after consulting the House authorities as aforesaid.

"That a copy of this resolution be forwarded to the Municipal Corporations association, with a view to taking combined action in the matter."

The proceedings terminated with a hearty vote of thanks to the Chairman for presiding.

THE PROPOSED TAX ON LIGHT IN FRANCE.

Some Statistics of Gas Consumption.

THE proposal brought forward by the French Finance Minister to put a tax on light-giving agents, to which reference has already been made in the "JOURNAL," is being strongly protested against by the Professional Syndicate of the Gas Industry—a body of gas engineers who keep close watch over matters affecting the industry. They have issued a *brochure* which has been reproduced as a supplement to each of our French contemporaries. In one section, figures are given to show that the proposed tax would be contrary to democratic principles, inasmuch as it would affect mostly the poorer classes of consumers. As is generally known, the "free-fitting" system is in operation in a number of places in France. In Paris, there are about 300,000 of these small consumers, occupying apartments at rentals below 500 frs., and representing about half the entire number of the Gas Company's customers. In the suburbs, there are more than 47,000 gratuitous installations, corresponding to rentals of less than 350 frs. per annum. The Continental Company have 22,000 of them (60 per cent. of the entire number of consumers); Lyons has 12,000; and Bordeaux 6000. Further, with the view of enabling those who are alarmed at the cost of a cooking-stove to enjoy the advantages these appliances possess for the small householder, they are let out on hire. In Paris there are 480,000 of them, and 83,000 in the suburbs—being 72 and 45 per cent. respectively of the total number of consumers. Tabulated statistics from a number of French provincial towns, having populations of 517,500 (Marseilles) downwards, show that 40 per cent. of the consumers spend less than 40 frs. per annum on gas, a like proportion spend from 40 frs. to 100 frs., 14 per cent. spend from 100 frs. to 200 frs., and only 6 per cent. spend more than the last-named amount. In the Paris suburbs, 61,000 consumers each burn less than 300 cubic metres (10,600 cubic feet), of gas—that is to say, not so much as 4 frs. worth per month; and 73,000 burn from this quantity up to 600 cubic metres (21,190 cubic feet), worth from 4 frs. to 8 frs. per month. In other words, 134,000 of the consumers out of a total of 190,000 burn less than 8 frs. worth of gas monthly.

In addition to the members of the gas industry, representatives of the citizens in the Municipal Council are hostile to the proposed tax. At a recent meeting, the subject was brought forward, and a resolution was passed that no new tax should be imposed upon consumers of gas or electricity, especially upon the smaller ones, representing 70 per cent. of the total number, whose already hard conditions of existence would be aggravated thereby. In support of the resolution, it was pointed out that the Paris budget would be directly affected by any diminution in revenue that might result from the imposition of a tax on gas and electricity, inasmuch as the Municipality are financially interested in the sale of these commodities.

ELECTRICITY SUPPLY MEMORANDA

Over what he anticipates will be our discomfiture, "Meteor" of the "Electrical Times" is rubbing his hands with unholy glee. The matter is a comparatively simple one, and yet one fraught with big considerations, of which our friend does not take the slightest notice. The Croydon County Council are the supreme authority in matters educational and electrical in the borough; and there has been discussion regarding the question of the lighting of certain of the elementary schools. The Electricity Committee naturally say to their fellow councillors of the Educational Committee: "Give us the lighting of your schools; we will do it at a cheap rate, so as to help in evicting from public establishments that objectionable and prosperous Gas Company, who are doing so much—admittedly in a proper commercial spirit—among the shopkeepers to injure the Electricity Department with high-pressure and low-pressure high-power gas-lamps." Figures are put forward which show that flat-flame gas-burners are used in some of the schools, and upright incandescent burners in others. Nothing, however, is used, so far as we can trace, in the way of modern inverted gas-burners. Prices are submitted to show that electricity will be somewhat the cheaper illuminant. But no statement is published in the electrical press as to the price per unit that the Electricity Department are proposing to charge the schools; no figures are given as to the illuminating power of the lamps; no statement is made as to the relative estimated number of hours the gas and electric lights are used. All that is produced is a jumble of figures and incomparables, and nothing as to the modern form of gas lighting. And "Meteor" rubs his hands with glee in anticipation of what we shall say about the matter! We have to say this, "Meteor," that if the Education Committee are being charged 3½d. per unit for current, modern inverted gas-burners will supply an *equivalent illumination* of better quality for an *equivalent number of hours* at a lower total price. Again we ask our old friend Mr. Cramb, the Electrical Engineer of Croydon, to disprove this by accepting our recent challenge and the conditions attaching to it.

For "Meteor's" Pleasure.

For the first time, when referring to this school-lighting question, "Meteor" alludes to our recent challenge to Mr. Cramb; and he describes it as a challenge to mortal combat in a gas laboratory. Why is it that "Meteor" will persist in misrepresenting us? We have never mentioned a gas laboratory in connection with the matter. To refresh the memory of our Meteoric friend, it may be repeated that we have some domestic inverted gas-burners (of a kind in considerable use), which have been doing daily service since the beginning of March last, *without a single mantle renewal*. They can be photometrically tested in comparison with 50-candle power metallic filament lamps—not in a laboratory if that is objected to, but in an ordinary room if desired—and on 3½d. worth of gas at 2s. 6d. per 1000 cubic feet, one of these gas-burners will be run for about 46 hours compared with about 16 hours with a 50-candle metallic filament lamp, using a unit of electricity, which costs 3½d. in Croydon. "Meteor" and Mr. Cramb know the condition on which we are prepared to enter into this little engagement—that Mr. Cramb signs the result, and consents to it being published and distributed throughout Croydon with his signature attached. We ask for nothing more. But the difference of 30 hours is a big one for the 3½d. If this difference is applied to the number of burners used in the schools in question—time conditions being the same for both illuminants throughout the year—there is something that has not been divulged by the figures that "Meteor" has published concerning this matter of the school lighting. What is it, "Meteor"? Once before there were figures published from Croydon regarding church lighting. "Meteor" remembers those figures, and the discussion upon them, as well as the not very dignified figure that certain people cut in connection with them.

Cramb and the Challenge.

There is one matter to which those responsible for the selection of lights for school use should pay greater heed than they are doing at the present time. A grave responsibility rests upon them in respect of the eyesight of the children. One member of the Croydon Council—to wit, Mr. Muggeridge—asserted that electricity was very much healthier than gas. We do not know anything of the qualifications of Mr. Muggeridge for saying this; but let us assure him that we have not any great belief in his personal competence for speaking on the subject. Mr. Cramb may have told him a thing or two. Mr. Cramb, as Vice-Chairman of the Electricity Publicity Committee, may also have handed him some of the literature of that body, which in its day has produced slander concerning gas that could only have been excusable if it had been the product of crass ignorance. But about eyesight. Really the question of economy upon which Mr. West and Mr. Muggeridge laid so much stress, in the discussion at the Council meeting, is of subsidiary importance compared with the question of the eyesight of the children attending the schools. It is impossible to-day to pick up an electrical paper without finding something in it about the glare and the high intrinsic brilliancy of the metallic filament lamp—an intrinsic brilliancy that authorities state is, per unit of incandescent area, 33 to 50 times greater than that of the incandescent gas mantle. To deliberately expose the eyes of children to filaments of such high intrinsic brilliancy is an act that should be made punishable. The electrical papers show week by week various methods by which the effect of the eye strain occasioned by such lights can be modified. But their adoption means additional expense and, according to their form, additional running expense. In the number of the "Electrical Times" that followed the one in which reference appears to the Croydon schools, we see the writer of "Installation Topics" very seriously condemns the neglect of glare by many electrical contractors. He says: "Considerations of comfort and absence of eye-strain receive far less attention than the saving of a few shillings in wiring." In "Electrical Industries," in an article discussing "Church Lighting," reference is made to eye-strain being one of the chief difficulties to prevent. Says the writer of that article: "One of the greatest sources of discomfort has undoubtedly been found in the glare produced by exposed lights. The effect on weak eyes is at once apparent, resulting in some cases in violent headache."

Eyesight and Responsibility.

Of the six million children attending the public elementary schools of the United Kingdom, 10 per cent. already suffer from defective vision; and is there to be a further massacre of the eyesight of the innocents through exposure of their eyes to the naked metallic filament? If this is to be one of the penalties of the municipal management of electricity concerns, through the forcing into schools of these metallic filaments, then it is a bad outlook for the nation. It is all very well to say that the lamps can be placed out of the line of vision of the pupils; but, with the restless eyes of children, where is the safe position, unless an expensive method of installation be adopted, and a method that will give ample soft light at working and reading levels. The seriousness of the position generally where direct lighting by metallic filaments is in use has been dealt with in a paper by Dr. Meredith Young, from which an extract was made in our columns last week (p. 39). Dr. Young holds that we at present know virtually nothing of the ultimate effects of these lamps when unwisely and improperly used; and they are used very "unwisely and improperly" in domestic service, shop lighting, and in some schools. Said Dr. Young, "I may tell you this as a concrete illustration of possibilities in this connection—that, out of about four electrical engineers connected with municipal electric lighting schemes whom I know personally, two are suffering from a kind of fibrillary tremor of the palpebral muscles, coupled with obvious photophobia, which may terminate in mystagmus." What thinks the worthy Muggeridge of this? Dr. Young believes there is a direct effect on the retina or optic disc due to over-stimulation and irritation caused by the high power rays of the light. Are the members of the Croydon Education Committee and of the County Council giving preferential consideration to this matter, or to the stupid notion of getting all buildings under municipal control as patrons of the electricity concern, and so cut out the Gas Company in these directions. In public life we look for a broader view than has taken possession of our local authorities in their dealings with lighting matters, where the electricity concern is under their control and gas is supplied by a company. This shows one of the limitations brought about by municipal trading; and it is not good for private enterprise, nor, in this instance, for the eyesight of scholars unless an expensive system of installation be adopted. Do Mr. West and Mr. Muggeridge still agree that electricity is the better light for school purposes? When answering this and giving reasons, will the latter councillor also tell us what makes him think that electric light is the healthier form of artificial illumination? "Meteor" of the "Electrical Times" and Mr. Cramb can inform him of the stagnant and noxious conditions of the atmosphere of the electric-lighted theatre of the Institution of Electrical Engineers; and stagnant air conditions are not healthy, more especially where a number of people are assembled. During lighting hours, the gas-burner keeps the air in motion, and it is a physical agency of no small importance in maintaining healthy conditions at breathing level.

A Heavy Penalty.

Most electrical pictures present us with two or more sides. Electric cooking is one of the pictures with more than two sides. Two of the sides are presented by two articles published simultaneously—the one in the "Electrician," and the other in the "Electrical Times." Optimism, in varied degree, is found in the tones of both articles—more so in that of the "Electrician" than in the other. "Electric cooking has come to stay," jubilantly shouts the former. No one has said that it has not; the extent of its staying powers is quite another matter. But we are given an indication of the writer's estimate on the point; and it is that at least 50 per cent. of the consumers of electricity for lighting purposes are prospective users of electric cooking apparatus. "There are now 600 odd public electricity supply undertakings in Great Britain," which "give a regular [?] service to probably more than a million consumers for lighting purposes." So that there are upwards of 500,000 of these people who are prospective users of electric cooking apparatus. Now we know. The information will be very cheering to the gas industry, that there is such

Now we Know.

a large proportion of faithless electricity consumers as the remaining 500,000; and the gas industry will see what they can do towards keeping the heating and cooking custom of a considerable proportion of the other half. The same article tells us that manufacturers of cooking materials, such as element strip and wires, insulators, and the metal work of stoves are so busy, and in some cases "frantically" engaged in extending their works. It is a pity for the shareholders that the accounts of more of these concerns do not reflect these wonderful conditions.

The Argument and the Price.

The article in the "Electrical Times" is written in an attractive vein. The author is Mr. J. Westcott. Gravity and wit are in the composition. In private life, the author is an electricity consumer; professionally, he is an electrical engineer; to earn a precarious living, he has taken to "the road." In interviewing his desired customers, he occupies their time by talking of electric cooking as a sort of side-subject. In his opinion, it is obvious that the cooking load is going to be *the* thing for electricity; and its potentialities are such that, he predicts, it is going to provide the biggest future boom in electrical work. Before getting to the main point of what he has to say, it is observed that he takes it for granted that 1d. per unit of electricity is the maximum price that must be charged for cooking purposes. Looking at the matter from the side of the electrical argument, we never can understand why this should be so. Take, for example, a joint electrically cooked, and thus saving (say) 1½ lbs. of "meat" at 11d. per lb., which represents 1s. 4½d. The expenditure of current for cooking a dinner is (say) 2½ units. Therefore, if the consumer paid 6·6d. per unit for cooking, he would, so runs electrical theory, be getting the heat for cooking his dinner for nothing—giving electricity (and not the cook's regulation of temperatures and time, and fancy for the degree to which the joint should be baked) the credit for the 1s. 4½d. worth of saving in "meat." Then why come down to 1d. per unit? Considering the nature of the cooking load, and that in a given district, the demand for cooking will synchronize for short periods during the day, the price for current for cooking should be higher than that for lighting; and electricians show that, according to their way of pricing-up vapour, the consumers can well afford to pay for current for cooking something approaching the maximum price per unit that Parliament permits them to charge. There is something wanting between the argument and the actual price.

A Point of Honour.

However, the point to which Mr. Westcott particularly draws attention is that he finds so many electrical men who are prepared to welcome a cooking load have not a cooker in their own houses. He thinks this is very wrong, and that every central station engineer and every electricity canvasser ought to have his house electrified for domestic purposes. Just think, he says, of the stir that would be made if the head of a gas undertaking took up electric cooking in his private dwelling. That just shows the narrow-mindedness of some of the men of the electrical industry. Such an event would be jumped at by them as something over which they could make commercial capital. In the gas industry, it is regarded as a matter of honour not to trespass upon the private lives of electricians to make capital out of their employment of gas. We know of men who make their living out of the electrical industry who are patrons of gas for all purposes—even lighting. Nearly every gas concern in the country has within its bounds chief and staff officers of electricity undertakings who use gas for cooking, water heating, and room warming. But we have yet to learn of any breach of honour that has led to commercial capital being made out of this by the staff of a gas undertaking. Further than this, there are on the shareholders' registers of numerous gas undertakings the names of well-known electrical men; but the fact is not made use of for the advantage of the gas industry. That by the way.

The Unbelievers.

Mr. Westcott has tried to fathom the reasons why so many electrical men are still without electric cooking apparatus; and he finds that the cost of outfit and the cost of wiring are the main obstacles. We would add that the cost of time and money in performing *all* the operations of which the gas-oven is capable also stands in the way. But what a singular picture this presents to the one submitted to view by the "Electrician," as referred to in a previous paragraph! What a curious picture it presents to the one showing savings of water charged out at 11d. per lb.! There are evidently electrical engineers who do not wish to be brought within the scope of the proposed Act providing for the care of feeble-minded persons. However, if the electricians and canvassers who have not adopted electrical methods of cooking, water heating, and room warming, cannot afford to do so, it simply shows that—they being as well paid as probably three parts of the men of the country who have to support themselves and their families by their labour—there is a considerable proportion of the householders of the country who likewise cannot afford to go in for domestic electrification. To cultivate electrical example, Mr. Westcott thinks that the manufacturers of electrical appliances should cut prices for cookers supplied for the private use of electrical men, that the undertakings they serve should pay for the installation except in the cases of the highly paid men, and in short, that electrical undertakings should insist on the chief officer using an electric cooker. We have heard of politics and even religious belief having something to do with the appointment of chief officers of undertakings; but for their employers to define any rule for the daily performance of the functions of their private households is going a step too far in interfering with the liberties of His Majesty's subjects. There, however, is the suggestion of Mr. Westcott. Upon which we ask, if cut prices for outfit and free installation are necessary inducements to electrical men to attempt to effect the apocryphal savings on their butchers' bill to an amount in the course of the year that would more than pay for the outfit and installation, what of the rest of the community who are not provided with these facilities, but pay full costs first or last? It is a funny condition of things.

Cooking and Water-Heating.

While speaking of cost, have our electrical friends noticed the fresh developments that inventors are bringing about in the gas-oven, in the shape of utilizing waste heat for raising the temperature of water? The results of trials under ordinary domestic working conditions with one of these combined ovens and water-heaters were published last week; and it will be seen—taking one result as an example [Dec. 1 test]—that a joint of lamb, weighing 5 lbs. 12 oz., a batter pudding, potatoes and rice pudding were cooked, and 19½ quarts of water were raised to a temperature of from 145° to 156°; and all on 35 cubic feet of gas. This, at 2s. 6d. per 1000 cubic feet, represents a cost of about 1d. What have the electric cooking advocates to say to this? Let us anticipate their answer. The quantity of water could be raised to the temperature in less time by a coal or coke fire at a cost of so much. Deduct this cost from the saving, at 11d., per lb. of the water evaporated from the meat cooked in the electric-oven, and there would be left more than enough to pay the electricity bill for cooking, water-heating, and the Insurance tax for domestics.

Heating and Cooking Tariffs.

According to "Electrical Engineering," there is a movement up in the north-east corner of England to try to co-ordinate in the district the tariffs for cooking and heating purposes. It seems that the scheme originated with the electrical section of the Newcastle Chamber of Commerce, who took the matter up after the Newcastle Exhibition. The towns concerned are Middlesbrough, Darlington, Stockton, West Hartlepool, and other supply authorities on Tees Side. These have been formed into two sections—north and south—who will discuss the matter from their own standpoints, and a combined meeting will then be held to arrange definite details. Our contemporary states that, "up to the present, not much progress has been made, but the movement is certainly one in the right direction." How so? We did not know that territory had anything to do with the factors constituting the substructure of tariffs. The original principles of electrical commerce are being debased on all hands in the electrical struggle.

Price Increases.

In the year's review (published last week) of matters electrical in which the gas industry is interested, reference was made to the fact that certain electricity undertakings had at length found reason for revising their tariffs, in view of the depression of the average receipt per unit, which was getting perilously near the unsafe line. West Ham and the Charing Cross Company were cited as cases in point; and the increased charge at Southampton for electric radiators was also alluded to. Fixed charges too were shown to be a failure from the experiences of more than one place. Cleckheaton now ranks itself with the undertakings that have been charging too low tariffs. Why these undertakings should get into these muddles over their tariffs is difficult to understand, with the several laws that the electrical industry has framed for the making of tariffs. About Cleckheaton, Lieut.-Colonel Atkinson informed the members that the price they were charging their large electricity consumers was inadequate. A Sub-Committee had been looking into the question, and had decided to recommend a 10 per cent. increase all round to lighting and power consumers. The result is that, instead of the Electrical Engineer being allowed to qualify for the "Point Five Club" 0·5d. is to be added to the prices at present charged. The 4d. units for lighting are now to be charged out at 4½d., and the 2d. power units at 2½d.

Proposed Tax on Gas-Mantles in Paris.—According to a statement which appeared a short time ago in "Le Temps," a proposal is on foot for taxing electric lamps, carbons for arc lamps, gas-mantles, &c. The matter has already been brought before the Budget Committee of the Chamber of Deputies by M. Klotz. It may be remembered that the Finance Minister proposed last year to tax gas, electricity, and acetylene equally with petroleum and candles. The proposal was rejected; but the Minister undertook for a Committee to inquire into the whole subject of readjusting the taxes on the varions lighting agents, in order to arrive at a basis of assessment. As a result of their labours, M. Klotz proposes to lower from 30 frs. to 20 frs. per 100 kilos. the tax paid on candles, and at the same time limit the octroi duties which the communes may impose on these articles, so that they shall not put on to the local tariff what the State will relinquish. In order to compensate for the above-mentioned concession of 10 frs., the other illuminating agents already named are to be taxed.

GAS BILLS FOR 1913.

[Second Article.]

In this article is commenced the review of the Bills of statutory gas companies who are desirous of being invested with extended powers.

The Blyth and Cowpen Gas Company are seeking further authorization from Parliament, including sanction to the acquisition of the Bedlington Gas Company. By the Company's Act of 1904, the ordinary shares of the Company were consolidated and converted into one stock of the nominal value of £53,704, bearing a uniform dividend at the rate of 5 per cent. per annum. Authorization was given in the same Act to the raising of additional capital not exceeding in the whole £100,000; and of this the Company have raised the sum of £14,469 by the creation and issue of £12,000 ordinary stock. Sanction in the same Act was given to the borrowing, in respect of the existing capital of £37,500, of any sums not exceeding £13,000; and in respect of the additional capital, one-third part of the amount actually raised. The Company have not exercised any of their borrowing powers. They now ask for an extension of their area, and the right to purchase under an agreement the undertaking and property of the Bedlington Gas Company. Part of the consideration for the sale is to be the payment in cash of £7500, and a sum equal to the expenditure properly incurred on capital account since May 20, 1911; and as further part of the consideration, the purchasers are to pay all debts and liabilities attaching to the undertaking, other than in respect of expenditure (if any) improperly incurred by the vendors on capital account between the date of the agreement and the completion of the sale. One of the conditions of the agreement provides that if, during the last quarter preceding the day of the completion of the sale, it is found that the amount of unaccounted-for gas—whether due to leakage of pipes, inaccurate meters, or any other cause—exceeds 24 per cent. of the gas supplied from the works, the purchasers are to be entitled, by way of compensation for the defective condition of the mains, pipes, and meters, and other plant and apparatus, to an abatement or reduction of the purchase money. Purchase is to be completed within two months after the Royal Assent is given to the Bill. In the event of dispute, reference is to be made to one of His Majesty's Counsel as Arbitrator, or, failing him, to an arbitrator appointed by the President of the Institution of Gas Engineers. Turning to the provisions of the Bill, the promoters propose an extension of limits so as to include Bedlington. In the extended area, the Company ask for the right to charge a price exceeding by not more than 9d. per 1000 cubic feet the price for the time being charged within the part of their limits of supply existing before the passing of the Act which is beyond a radius of 1250 yards from the centre of the gas-works at Blyth. Sanction is requested to the stopping of a portion of a footpath leading from Blyth to Cowpen Quay. Power is also desired to enable the Company to issue shares or stock, for the purposes of the agreement to purchase the Bedlington Gas-Works without the obligation to offer such shares or stock by public auction or tender. [*Parliamentary Agents: Messrs. Dyson and Co.*]

The Bournemouth Gas and Water Company are in Parliament for power, among other purposes, to acquire the undertakings of the Christchurch Gas Company and the Wimborne Minster Water-Works Company, Limited. The Christchurch Gas Company have raised the sum of £28,080, divided into 1808 £10 shares entitled to a maximum dividend of 10 per cent., 500 additional ordinary £10 shares entitled to a maximum dividend of 7 per cent., and 500 £10 preference shares, entitled to a maximum dividend of 6 per cent. In addition, £8750 has been raised by debentures, bearing interest at the rate of 5 per cent. The Wimborne Water Company have created and issued 700 shares of £10 each, and have raised £1500 by debentures, bearing interest at the rate of 4 per cent. per annum. It is intended that the Wimborne Company shall issue before the date of transfer 100 further £10 shares. The agreement with the Christchurch Company provides for the purchase sum being determined by a single arbitrator to be mutually agreed, or, in case of dispute, to be appointed for the purpose by the President of the Institution of Civil Engineers; but the Arbitrator is not to make any allowance for compulsory purchase, and "shall determine the value of the undertaking on the basis of its value as a going concern as between a willing buyer and a willing seller"—the arbitration being deemed to be a reference within the meaning of the Arbitration Act, 1889, and any statutory modification or extension thereof. There are, in addition, several conditions in the agreement, but of quite an ordinary character. Regarding the Wimborne Water Company, the Directors are empowered to issue to the existing shareholders at par the 100 £10 shares already referred to—payment being made in cash previous to the transfer. As part consideration for the transfer, shares in the Bournemouth Company are to be issued in the following proportion: One "B" 7 per cent. additional share in the Bournemouth Company, together with £5 in cash for every £10 share held. As further part of the consideration for transfer, the Bournemouth Company are to satisfy and discharge all debts, liabilities, and obligations of the Wimborne Company outstanding at the date of transfer, and *bonâ fide* incurred in carrying on the business. As further part of the consideration, the Bournemouth Company are to pay the Wimborne Company before the date of transfer (or the latter may retain out of moneys in their hands which, on completion of transfer, would otherwise belong to the Bournemouth Company) £500 for distribution among the Directors by way of compensation for loss of office. A sum of £50 is also to be handed to the Auditors as compensation for loss. Clauses in the Bill provide for confirmation of the agreement and for the transfer of the two undertakings, as well as for detail matters surrounding the transaction. The limits of the supply for gas and water of the Bournemouth Gas Company are to be extended so as to include the areas of the two Companies, if Parliament concurs in the purchase schemes. Conditions as to water charges in the extended area are specified; and there follow the prices proposed to be charged per 1000 cubic feet of gas in the limits of supply of the Christchurch Company. For two years from the date of transfer, the charge is to be 1s. in excess of the price actually charged to private consumers in the borough of Bournemouth; and then every two years the excess comes down by 2d., until at the expiration of eight years from the date of transfer not more than 4d. is to be the excess. The Bournemouth Company propose power to raise additional capital to the amount of £200,000 by the creation and issue of new ordinary shares or stock. The dividend on such part of this as is issued as ordinary capital is to be 7 per cent., and not exceeding 6 per cent. on such part as is issued as preference. Borrowing power to the extent of one-third part of the issued additional capital is asked for. It is proposed that the standard illuminating power of the gas from Jan. 1 next year shall be 14 candles. A stand-by clause relating to both gas and electricity is included in the Bill. [*Parliamentary Agents: Messrs. Crowders, Vizard, Oldham, and Co.*]

The Crowborough Gas Company are proposing to spread their operations into electricity supply, and, if the Bill secures Royal Assent, to be thenceforth known as the Crowborough District Gas and Electricity Company. They hold that they can "conveniently and economically work and maintain an electricity undertaking jointly with their gas undertaking." The Company also want additional capital powers. The capital authorized in 1899 was £24,000 in ordinary shares of £1 each, with power to raise £6000 by borrowing. All the share and loan capital has been raised and expended; and the Company now owe £8252. Lands are scheduled for works purposes. It is proposed that there shall now be a transfer from a maximum price to a standard price—5s. being set down for the latter. On the consolidated ordinary stock the sliding-scale will operate annually on the lines of 2s. 6d. for variations of a penny in price. The electricity area is to coincide with the gas limits; and all the requisite powers for generation and supply are sought. From Jan. 1 next, it is contemplated that the ordinary shares shall be consolidated and converted into a stock of the nominal amount of £30,000, bearing a uniform dividend of 5 per cent. Authorization to the raising of additional capital not exceeding £36,000 is desired. The promoters also seek power to borrow in respect of the existing ordinary capital (inclusive of the £6000 already raised) £8000, and to the amount of one-third part of the issued additional capital. If the electricity powers are not exercised within three years, or such extended time as the Board of Trade may prescribe, the additional capital powers are to be reduced to £21,000. Referring to both gas and electricity, a stand-by clause is included. [*Parliamentary Agents: Messrs. R. W. Cooper and Sons.*]

The Grays and Tilbury Company are also out for extension, there being in their vicinity places not now supplied with gas, and others served otherwise than under statutory authority. The Company are proposing to extend their limits, and to purchase four concerns. The first is the Stanford-le-Hope Gas Company, Limited, who have an issued capital of £5310 ordinary £1 shares, entitled, by their Order of 1905, to a statutory dividend of 10 per cent. The Company have also raised by debentures £1040. There is next the Ingatestone and Fryerning Gas Company, Limited—a non-statutory concern. The capital is represented by 383 fully-paid shares of £5 each, and £300 has been raised by the issue of debentures, bearing 4 per cent. interest. Altogether on capital account a sum of £2466 has been expended. Then a number of private individuals are carrying on the Laindon Gas Company without statutory authority; and, lastly, Mr. Worthington Church is supplying gas in Great Burstead, and some half-dozen other parishes in Essex. With the proprietors of these concerns (excepting, we gather, Ingatestone) there has been agreement for transfer. The Bill provides for a considerable extension of area. In the added area, the Company ask for the right to charge a price exceeding by not more than 6d. per 1000 cubic feet the price for the time being charged within the portions of the existing limits of supply, other than the urban district of Grays Thurrock and the area included within a radius of one mile from the centre of the Company's gas-works. Lands and works powers are included. Additional capital to the amount of £150,000 is sought, with one-third borrowing powers. The Company seek sanction to apply for a Provisional Order to supply electrical energy. With regard to the Ingatestone Company, authorization is sought to enter into an agreement with them and to carry it into effect. The agreements arrived at with the other owners are found in the schedules. Regarding the Stanford-le-Hope Company, the purchasers are to issue to the shareholders fully-paid "B" ordinary £10 shares, in the proportion of ten-and-a-half such shares for every 100 shares. The purchasers are also to hand over £500 to be divided as compensation between Directors, Secretary, Manager, and other officers. As to the purchase of the Laindon Company, the consideration is to be £350 in cash, and the issue

to the Laindon Company of £1350 nominal 4 per cent. debenture stock of the Grays Company. The works in which Mr. Worthington Church is interested, and which are to be taken over, are those at Billericay and Rayleigh. On the signing of the agreement, the purchasers paid to the vendor £1250 on account of the purchase money—the amount to be repaid, without interest, in the event of Royal Assent not being obtained to the Bill. As part consideration for the sale, the purchasers are, on the passing of the Bill, to issue to the vendor 150 fully-paid "B" shares of £10 each in the Company. The vendor is also to receive £23,323 (less the £1250 paid on account), and such sums of money not exceeding in the whole £5000 as shall, with the consent of the purchasers, have been expended by the vendor after the date of the agreement in laying mains for, and in supplying gas to, Hadleigh, Eastwood, and South Benfleet, and in supplying pipes, meters, stoves, and other fittings, with interest at the rate of 4½ per cent. per annum from the date of the expenditure. [*Parliamentary Agents: Messrs. Dyson and Co.*]

The business of the Harrow and Stanmore Gas Company has been in recent years expanding by leaps and bounds; and though the Company were only in Parliament in 1903, they find it necessary to apply again for increased powers. The main objects of the present application are the consolidation of the existing capital, the obtaining of additional capital powers, and authorization to the construction of new works. The total of the various descriptions of capital authorized by prior Acts is £188,000, and the capital issued and paid up (including £23,790 premiums) is £177,720—thus leaving £10,280 of ordinary capital (7 per cent.) unissued. The loan authorization amounts to £52,250; and there has been raised £45,790 by the creation and issue of debenture stock. It is proposed that the "A" and "C" ordinary shares be converted into one class of ordinary stock, entitled to a standard dividend at the rate of 5 per cent. The scheme provides that the holders of every "A" ordinary £10 share shall be entitled to £20 of ordinary stock, and the holders of every "C" ordinary £10 share to £14 of stock. The "B" ordinary shares and the existing guaranteed shares of the Company (all of £10 each) are to be converted into one class of preference stock, bearing a uniform interest of 5 per cent. The holders of the shares are to receive £14 of the preference stock. The additional capital powers sought are to the amount of £250,000. The Company also retain the power to raise the unissued capital (£10,280) under their existing powers. The sliding-scale of dividend and price will be, following the conversion, altered so that it will apply half-yearly on the lines of 1s. 3d. per cent. increments or decrements of dividend for decreases or increases of 1d. in price. The borrowing powers in respect of the 1903 capital and the new additional capital, it is proposed, shall be on the usual line of one-third part. Some 5 acres of land belonging to the Company, and lying to the west of the existing works, and bounded on one side by the South Harrow branch of the Metropolitan Railway, are scheduled for gas-works purposes. Powers for the construction of bridges over a footpath between the Company's works and the Metropolitan Railway, and for any works connected therewith for the conveyance of material, are included in the Bill. The succeeding clauses are of ordinary character until we come to those which deal with the power to establish a benefit fund and profit-sharing by employees. The benefit fund is to be provided by the appropriation out of revenue of any sum not exceeding ½d. per 1000 cubic feet during each half year. The amount of the sums so appropriated, and standing to the credit of the fund, is not to exceed the amount the Directors would have been entitled to appropriate at the specified rate during the preceding five years. The uses of the fund are defined. Then follow clauses referring to profit-sharing on the lines of precedent. A stand-by clause covering both gas and electricity and other clauses common in modern gas legislation will bring the Company's powers up-to-date. [*Parliamentary Agents: Messrs. Sherwood and Co.*]

Electricity powers are sought by the Herne Bay Gas Company, who, if the measure receives the endorsement of Parliament, will henceforth include in their title "and Electricity" after "Gas." From the preamble of the Bill, we learn that the Herne Bay District Council obtained an Electric Lighting Order in 1909, but have not exercised the powers conferred upon them. They have now agreed to the repeal of the powers, and to powers being conferred upon the Gas Company for the supply of electrical energy. The area of supply is to be the urban district. The Company propose the appropriation and use for the purpose of their electricity undertaking of any lands acquired for the purposes of their gas undertaking; but it is added that they shall not construct a generating station on any land acquired by them after March 31, 1909, except in accordance with, and subject to, the provisions of section 2 of the Electric Lighting Act, 1909. The remaining electricity powers are in normal form. Further share capital is proposed not exceeding £15,000—provided that the share capital of the Company for the purposes of the Herne Bay Gas and Electricity Acts, 1899 to 1913, shall not exceed in the whole the sum of £94,000, unless the Company are hereafter authorized to raise further capital by Provisional Order. If within a period of two years after the passing of the Act, or such extended time as the Board of Trade may prescribe, the Company shall have failed to commence the supply of electricity, the additional capital is to be reduced to £7000. Separate accounts are provided for the two undertakings. Out of the capital raised, there is to be carried to the credit of the capital account of the gas undertaking the value of all land acquired for its purposes, but used for the electricity undertaking. The expenses of direction and management, and any expenses common to both the gas and electricity undertakings, are to be from time to time apportioned between them as nearly as conveniently practicable, in proportion to the amount of capital for the time being expended on the gas undertaking and the electricity undertaking respectively. Power of purchase is given to the Council, on the terms of a twelve months' notice in writing expiring at the end of ten, twenty, or thirty years from the passing of the Act. The price to be paid to the Company is to be a sum equal to the total amount expended upon the undertaking and chargeable to capital account as appearing in the Company's accounts, together with a sum equal to 25 per cent. upon such total amount if the notice expires at the end of ten years, 20 per cent. upon such total amount if the notice expires at the end of twenty years, and 10 per cent. upon such total amount if the notice expires at the end of thirty years. But an option of a larger order is conferred on the Company—the proviso being inserted that if, within three months after the service of notice to purchase, the Company give notice to the Council that they require them not to purchase their electricity undertaking unless they also purchase their gas undertaking, the Company are not to be obliged to sell their electricity concern unless the Council obtain the sanction of Parliament to purchase, and do purchase, the gas undertaking on the terms mentioned in section 29 of the Herne Bay Gas Order of 1899. But nothing in this section is to affect the power of the Council as the local authority to purchase under section 2 of the Electric Lighting Act, 1888. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, and Co.*]

The Redcar, Coatham, Marske, and Saltburn Gas Company have a total paid-up capital of £64,000. The Company have also borrowed by the creation and issue of bonds (which are now outstanding) £7795, entitled to interest at rates varying from 3½ to 4 per cent. per annum. The Company now ask for additional capital powers and for authorization to the construction of works on the land which they acquired under their Act of 1876 adjoining their existing gas-works. In the clause dealing with this matter, there has been inserted the words "by them" which restricts (contrary to the decision of the Joint Committee) residuals dealings to the products arising from their own gas manufacture. The Company propose that the standard illuminating power shall be 12 candles. Among a number of modern clauses is a stand-by one referring to both gas and electricity. Additional capital powers to the amount of £20,000 are required, to carry 7 per cent. dividend on the portion issued as ordinary and 6 per cent. on that raised as preference. In respect of the existing capital, the Company desire the power to borrow (inclusive of the £7795 already borrowed) the sum of £24,016; and in respect of the additional capital one-third part. Sanction is sought to the Company entering into an agreement with the North-Eastern Railway Company with reference to the construction of a railway siding near the gas-works. The Company are also seeking power to construct over West Dyke Lane a gantry or passage, with rails and mechanical apparatus, for the conveyance of coal and other materials to and from the gas-works from and to the siding. [*Parliamentary Agents: Messrs. Durnford and Co.*]

"Transactions" of the Société Technique.

We have received the volume of proceedings of the Société Technique du Gaz en France for the past year. It contains the report of the thirty-ninth annual congress, held in Paris from the 18th to the 20th of June, under the presidency of M. Henri Marquisan, a Director of the Marseilles Gas and Electricity Company. Most of the technical matter in the volume has already been noticed in the "JOURNAL." The papers are illustrated by numerous diagrams and by thirteen plates. The reports of the Special Committees of the Society, abstracts of which have appeared in our columns, are included. A report is given of the resolutions adopted at a meeting of the French Committee of the International Electrotechnical Commission, held in Turin in September, 1911, on symbols, diagrams for alternate currents, and specifications for continuous-current machines; and this is followed by an account of the gathering of gas engineers in Amsterdam in connection with the International Gas Exhibition, at which the Society were represented by MM. Masse and Laurain. Particulars are furnished of the competitions for the prizes for the current session, the names of the recipients of those already awarded are given, and also the names and addresses of the members, &c. A valuable feature of the volume is a subject-matter index to the "Transactions" of the Society from 1874 to 1912. In a supplement will be found a tabulated synopsis of the technical abstracts which have appeared in the "Revue Bibliographique," started by the Society in 1908. This is followed by a review of the legal business of the year 1910-11 by M. de la Taste; and the index to the cases noticed as far back as 1884 is brought up to Aug. 3, 1911. The volume has been produced under the supervision of M. Bouron, the Secretary of the Society.

According to a statement in "The Times," the Royal Automobile Club has joined with the Automobile Association and Motor Union and the Society of Motor Manufacturers and Traders in the formation of a Commission to study and investigate thoroughly the question of benzol as a substitute for petrol. The work of the Commission will begin immediately.

STATISTICS OF GAS UNDERTAKINGS.

Further Extracts from the Final Report on the Census of Production.

In the last number of the "JOURNAL" (pp. 31-2), we gave some statistics relating to the gas undertakings of the United Kingdom, extracted from the recently issued final report on the first Census of Production of the United Kingdom. The following are additional figures bearing upon the subject.

COST OF WORKS.

A summary of the particulars furnished in respect of the cost of works of construction, alteration, and repair in connection with the buildings, plant, mains, &c., executed by the working staff of companies in the year of return (1907)—covering wages, materials, and establishment charges attributable to the work—is shown below; the work given out to contractors being excluded.

	Construction.	Alteration and Repair.	Total.
Buildings and plant.	£172,000	£1,207,000	£1,479,000
Street mains	324,000	378,000	702,000
Work not separately distinguished	—	—	172,000
Total cost of work done			£2,353,000

The following are similar figures relating to public authorities:

	Construction.	Alteration and Repair.	Total.
Buildings and plant.	£38,000	£610,000	£648,000
Street mains	164,000	227,000	391,000
Work not separately distinguished	—	—	142,000
			£1,181,000

PERSONS EMPLOYED.

The average number of persons employed on the last pay-days in January, April, July, and October in connection with undertakings conducted by companies is returned as 54,866.

	Wage-Earners.	Salaried Persons.	Total.
At gas-works	48,175	5417	53,592
At tar-distilling and ammonia works	1,238	36	1,274
Total	49,413	5453	54,866

The following statement affords some indication of the seasonal variation in the employment of wage-earners; the figures showing the number of persons employed on last pay-days in the months named:

	January.	April.	July.	October.
At gas-works	51,628	46,759	45,265	49,049
At tar-distilling and ammonia works	1,289	1,264	1,161	1,239
Total	52,917	48,023	46,426	50,288

In connection with public authorities, the report furnishes the following figures in regard to the persons employed.

	Wage-Earners.	Salaried Persons.	Total.
At gas-works	25,110	3088	28,198
At tar-distilling and ammonia works	361	15	376
Total	25,571	3103	28,574

The following particulars show the seasonal variation in the employment; the figures, as in the case of the companies, being the number of wage-earners employed on the last pay-days in the months named:

	April.	July.	October.	January.
At gas-works	23,724	23,171	25,755	27,803
At tar-distilling and ammonia works	346	282	407	410
Total	24,070	23,439	26,162	28,213

The following figures relate to the salaried persons employed by companies.

	January.	April.	July.	October.
At gas-works	5,400	5,428	5,414	5,424
At tar-distilling and ammonia works	34	35	37	37
Total	5,434	5,463	5,451	5,461
Total of the two classes	58,351	53,486	51,877	55,749

The numbers of salaried persons employed by public authorities were—

	April.	July.	October.	Jan. (1908).
At gas-works	3,088	3,077	3,086	3,099
At tar distilling and ammonia works	15	14	16	16
Total	3,103	3,091	3,102	3,115
Total of both classes	27,173	26,530	29,264	31,328

POWER IN GAS-WORKS.

The following tables show the total capacity (horse power) of the engines employed in gas-works.

Companies.

	Gas-Works.	Tar-Distilling and Ammonia Works.	Total.
Steam-engines—			
Reciprocating	42,680	1602	44,282
Steam-turbines	1,087	—	1,087
Total steam-engines	43,767	1602	45,369
Internal combustion engines (gas, oil, &c.)	10,678	387	11,065
Electric motors (so far as returned)	750	47	797
Water power	100	5	105
Other power	115	—	115
Total	55,410	2041	57,451

Public Authorities.

	Gas-Works.	Tar-Distilling and Ammonia Works.	Total.
Steam-engines—			
Reciprocating	26,804	617	27,421
Steam-turbines	646	30	676
Total steam-engines	27,450	647	28,097
Internal combustion engines (gas, oil, &c.)	4,904	18	4,922
Electric motors (so far as returned)	369	—	369
Water power	68	—	68
Other power	162	—	162
Total	32,953	665	33,618

Particulars of the capacity of dynamos owned or of electricity generated or purchased were not required to be stated in either case.

COAL-TAR PRODUCTS.

Though the following statistics of coal-tar products do not strictly speaking refer to the manufacture of gas, they are sufficiently closely connected with it to justify their insertion here. They are taken from the section of the report furnishing particulars relating to chemical and allied trades.

—	Returned on Schedules for the Chemical Trades.		Returned on Schedules for Other Trades.	
	Quantity.	Value.	Quantity.	Value.
Anthracene	Lbs. 3,319,000	£ 8,000	Lbs. 296,000	£ 2,000
Benzol and toluol	Gallons. 3,278,000	120,000	Gallons. 3,049,000	69,000
Carbolic acid	670,000	44,000	19,000	1,000
	Cwt. 149,000	145,000	Cwt. 22,000	26,000
Coal tar—				
Crude	Tons. 25,000	26,000	Tons. 833,000	819,000
Refined and varnish	Gallons. 4,815,000	54,000	Gallons. 1,685,000	12,000
Naphtha	4,327,000	150,000	290,000	8,000
Naphthalene	Cwt. 255,000	33,000	Cwt. 44,000	12,000
Pitch	Tons. 537,000	684,000	Tons. 176,000	175,000
Tar, oil, creosote, &c.	Gallons. 49,022,000	545,000	Gallons. 17,690,000	157,000
Other sorts, unspecified	..	346,000	..	50,000
Total	..	2,155,000	..	1,331,000

Under the heading of "Fertilizers," the following figures are given for sulphate of ammonia: Returned on the schedule for the fertilizer, &c., trades—Quantity, 1000 tons; value, £13,000. Returned on schedules for other trades—Quantity, 263,000 tons; value, £2,855,000. Total quantity, 264,000 tons; total value, £2,868,000.

According to a telegram received through Reuter's Agency, the Santiago de Chile Chamber last Wednesday agreed to the grant of a sum of £40,000 for propaganda work for the benefit of the nitrate industry.

The following reference to the honour of knighthood recently conferred upon the Governor of the Gaslight and Coke Company is made in the current number of the Company's "Co-Partners' Magazine": "On the eve of going to press, we learn with infinite satisfaction of the inclusion of our well-beloved Governor in the New Year's list of those selected for honour by His Majesty the King. We all feel that the knighthood graciously bestowed upon the Governor is also a meed of recognition of the good service rendered to the country by the gas industry in general, and by the Company to the Metropolitan community in particular. That Sir Corbet Woodall may long be spared to enjoy his honours will be the hearty wish of all co-partners of the Company, and also of the wider circle of those who are proud to claim him as a friend, or have learnt to respect him as a wise counsellor, or to bless him as a benefactor."

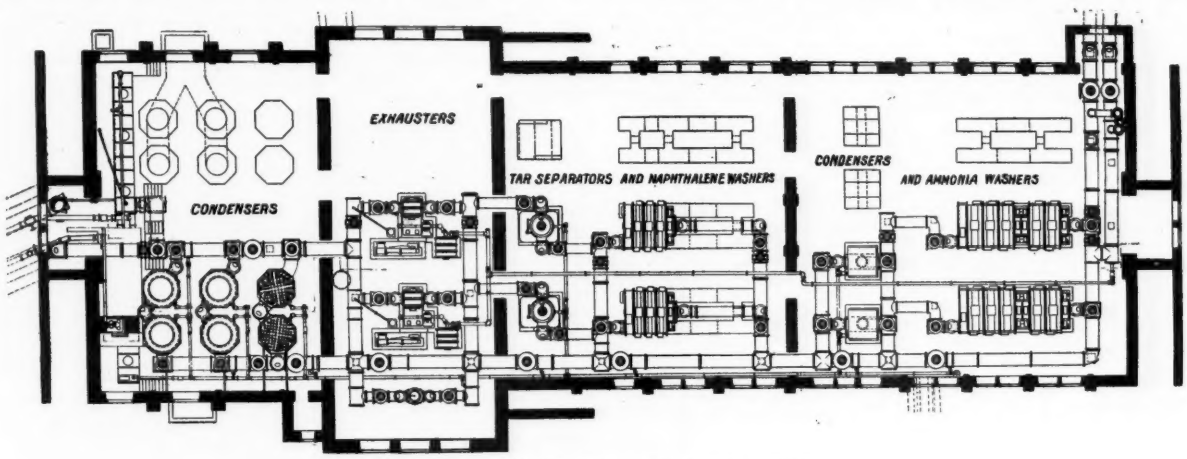
THE GAS SUPPLY OF MUNICH.

We give to-day the second instalment of the description of the Municipal Gas-Works at Munich. An account of the development of the gas supply in the city under municipal control, together with a description of the carbonizing and coal and coke handling plant at the Dachauerstrasse Gas-Works, appeared in our last issue (pp. 22-8). The following particulars, dealing with the apparatus installed, have been prepared from the "Commemoration Volume" issued by the Corporation of the City of Munich.

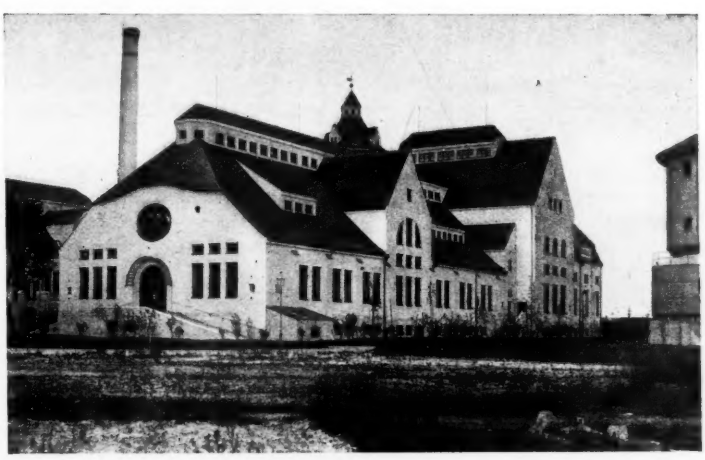
Apparatus.

The apparatus was installed with the object of meeting the whole requirements of one of the two main sections, of 5¼ million cubic feet per diem capacity, for which the design of the works provides. Reserve plant was also provided where needed. The scheme of two systems of apparatus was taken into account in the works connections from the settings, which are brought together in a chamber underneath the bunker for the producer coke. The mains can, however, be connected to either of the two sections of apparatus. The gas-mains, tar-mains, &c., from this chamber are placed in a reinforced concrete underground channel, by which they pass to the apparatus house. The same channel serves for the steam and water pipes for the retort-house. This underground channel or tunnel admits of easy access to the pipes at all times, while not interfering with the extension of the coke-store over the ground through which they pass.

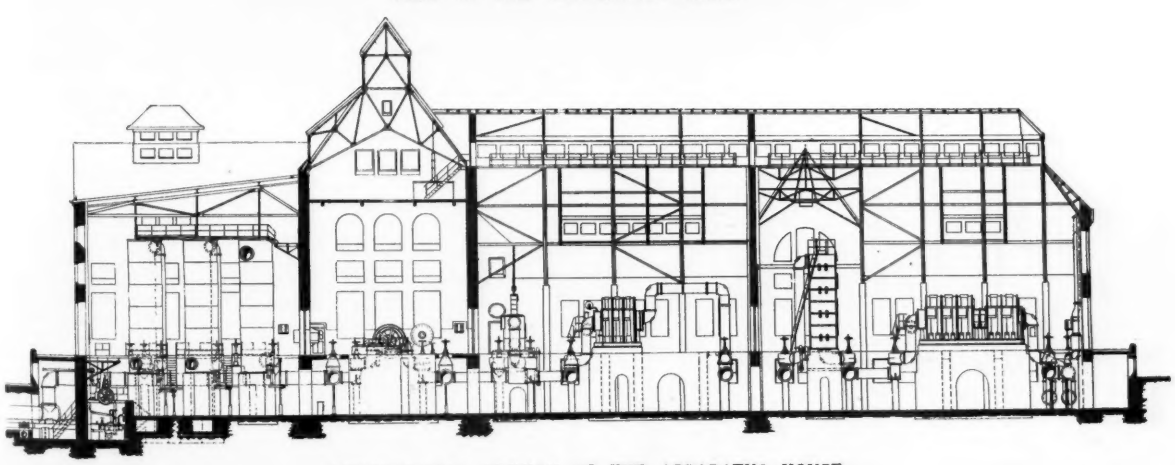
The northern portion of the apparatus house contains four wrought-iron annular atmospheric condensers, each with an air-cooled surface of 1561 square feet. There are also two wrought-iron tubular condensers, each having 3283 square feet of water-cooled surface. The atmospheric condensers operate in pairs



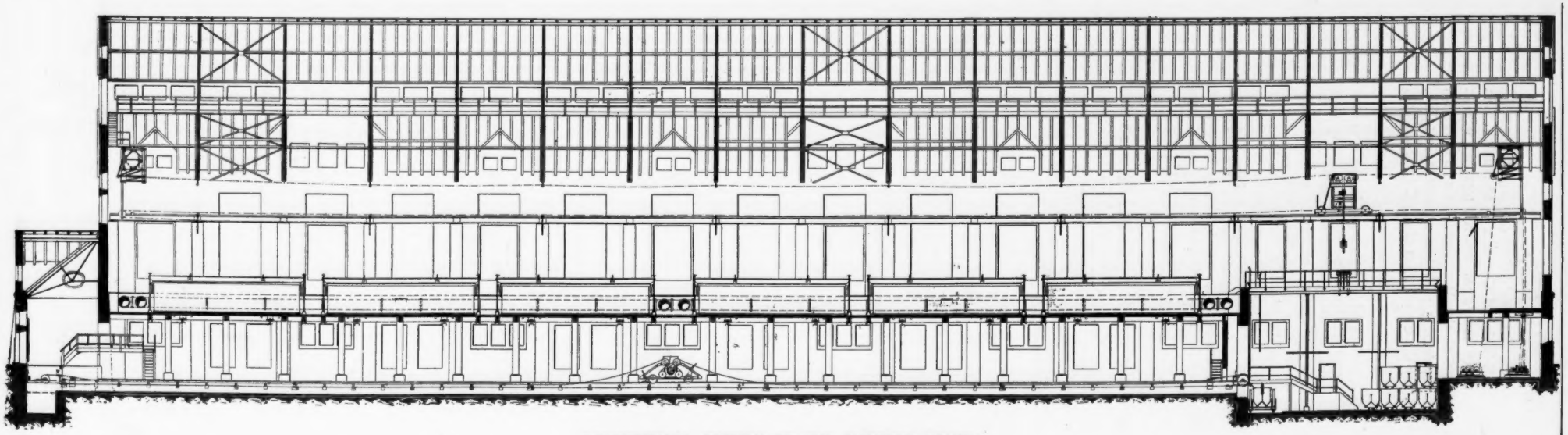
BASEMENT PLAN OF THE APPARATUS HOUSE.



VIEW OF THE APPARATUS HOUSE.



LONGITUDINAL SECTION OF THE APPARATUS HOUSE.



LONGITUDINAL SECTION OF THE PURIFIER HOUSE.

connected in parallel by pipes, 28 inches in diameter, which are connected with the 36-inch foul-gas main. The gas passes through the water-tube condensers in series. In the next room of the apparatus house there are two three-blade exhausters which, at eighty revolutions a minute, pump 212,000 cubic feet of gas per hour. Each exhauster is driven by a horizontal steam-engine with piston 10 inches in diameter and 20 inches stroke. These, as well as the rest of the engines on the works, are lubricated from a central point, in order to reduce attendance. The exhausters are lubricated with the tar from the chamber settings by means of lubricating pumps. Each gas exhauster is connected by band-gearing with an air exhauster of 4768 cubic feet per hour capacity. The air drawn in passes through a meter and is mixed with the gas before the sulphur purifiers. A Dessau bye-pass governor is placed before the exhausters to control the pressure in the foul main.

Next to the exhauster room is a room in which are two Pelouze and Audouin tar-extractors, with four double bells. The bells can be freed from adhering tar, when required, by steam. Two naphthalene washers with three compartments are provided in the same room for the removal of the traces of naphthalene remaining in the gas from the chamber settings. The amount of naphthalene in this gas, however, is so small that washing for its extraction can be dispensed with. Space is provided alongside these washers for a subsequent installation of cyanogen washers. The ordinary washing plant is in an adjoining room, and comprises two Reutter condensers, 80 inches by 80 inches horizontal section, and having 3983 square feet of cooling surface, with two "Standard" washers, each with seven chambers. The Reutter condensers are sprinkled with weak liquor. From the washers two 36-inch mains lead to the purifier house. The valves of these mains are connected so that it is impossible to close both at the same time. Safety valves are provided between the washers and the purifiers, which, in the event of a sudden rise of pressure in the main, allow the gas to escape into the open, so as to avoid its finding its way into the rooms of the apparatus house.

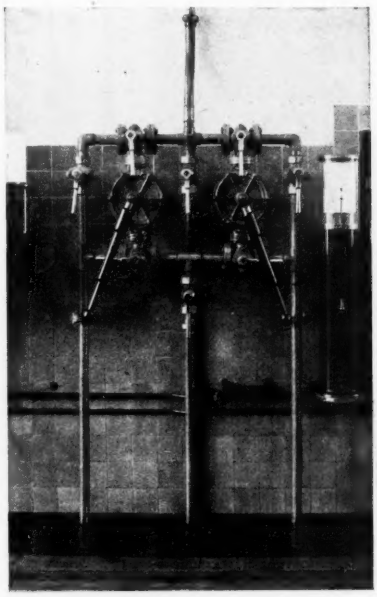
In the basement before the condensers there are two tar and liquor receiving tanks, each holding 2640 gallons, into which all the liquid condensing between the retort house and the apparatus house flows. It is pumped by two steam-pumps into the separating tank. The pumps have a capacity of 2200 gallons per hour, and are lubricated from a central point. There are five wrought-iron tanks, of 4400 gallons capacity, on top of the reinforced concrete roof of the exhauster room, which are used for clean water, liquor, and fresh and used anthracene oil. The exhauster room serves as the central control room for the works. It has a pressure-gauge board, on which are thirty single-limb gauges with fixed zero. Thus the pressures prevailing over all the works can be observed at any time at this point. The two governors controlling the pressure in the outlet mains from the works are also controlled from this point by means of valves which force oil from an overhead tank into or out of the seals of the governors, which are about 650 feet distant. This method of control has proved simple and trustworthy, and changes are effected more rapidly than by hand weighting of the governors. The pressure is set according to the indications of a Klobukoff distance regulator, which indicates in the exhauster room the pressure in the mains at the offices of the gas undertaking in the town, about $3\frac{3}{4}$ miles from the works. The levels in the tanks in the water-tower and in the tar and liquor tanks are also shown in the exhauster room. The attempt to concentrate the control of the working of the apparatus has been so far successful that only two men per shift are required for the purpose.

Purifying Plant.

The purifiers are arranged in two sets, each comprising three vessels, and each set having a capacity of $5\frac{1}{4}$ million cubic feet in twenty-four hours. The purifier plant is connected with the apparatus house by a 36-inch main, which branches in the purifier house into two 28-inch mains—one going to each of the sets of purifiers. The purifying vessels are 80 inches deep and 33 feet by 39 feet. They contain four layers of material 12 inches deep. The foul gas may be passed through the layers either in a single stream from top to bottom or divided into two or four streams. The purifiers are of the ordinary type, except that the bottoms are of sheet iron 0·15 inch thick, instead of cast iron. The metal sheets are protected by a layer of asphalt, 1 inch thick. The lids are sealed in cups about 30 inches deep and $6\frac{1}{2}$ inches wide. The lids are riveted and stiffened externally by I girders, and are held down by 16 bolts to the reinforced concrete floor on which the vessels stand. There are four outlets provided to each vessel, for discharging the material into the basement below. The inlet and outlet connections are furnished with Gareis centre valves. There are two valves, 6 inches in diameter, for passing air into the purifiers. Four lifting jacks are provided to each lid, which weighs 18 tons, for raising it by means of the crane in the roof of the house.

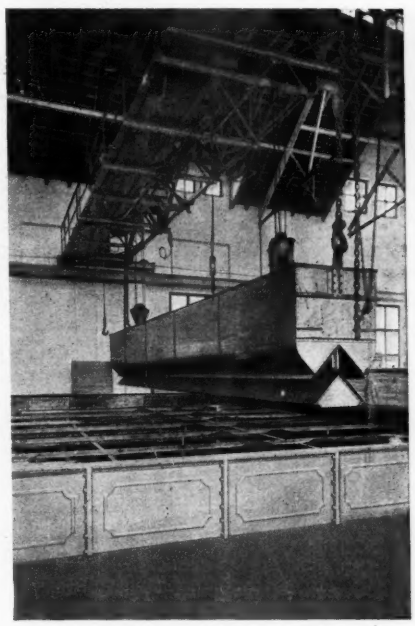
A travelling crane, having a span of 70 feet and capable of lifting 18 tons, is carried by brackets on the outer walls of the purifier house. This crane is used for raising the lids of the

vessels and for moving the purifying material. Electric driving of the crane being precluded on account of the risk of accidents, it is operated by wire ropes. The ropes pass over horizontal girders on the end of the walls of the house to two winding drums in the basement of the house. These winding drums are driven by toothed-wheel gearing by a 15 H.P. motor. The crane lifts at the rate of either 5¼ feet or 1 foot in a minute, as desired, and travels at the rate of 39 feet per minute. When a vessel has to be charged with purifying material, the crane conveys, from the open space at one end of the building, ten wrought-iron skips or boxes (each of 19½ cubic yards capacity) one after the other to the purifier, where the bottoms of the skips are opened and the material is discharged into the purifiers. The crane is moved while the material is being discharged, so that it is distributed over the purifier.



ARRANGEMENT FOR ALTERING THE PRESSURE THROUGH THE GOVERNORS.

For conveying, distributing, and collecting the purifying material in the revivifying space in the basement, a band conveyor of Balata fibre, 295 feet in length and 28 inches wide, driven by a 9 H.P. electro-motor, is provided. The direction of travel of the band conveyor can be reversed. It passes over a pair of distributing waggons, which automatically distribute the material over the length of the revivifying floor. The revivified material, when ready for removal, is shovelled or tipped into two waggons on the level of the floor and passing over the conveying band, on to which it is discharged through longitudinal slits in the waggons. It is automatically carried by the conveyor to the south end of the purifier house, where the skips are filled with it as required. The band conveyor carries from 19½ to 26 cubic yards of material per hour.



VESSEL FOR FILLING THE PURIFIERS.

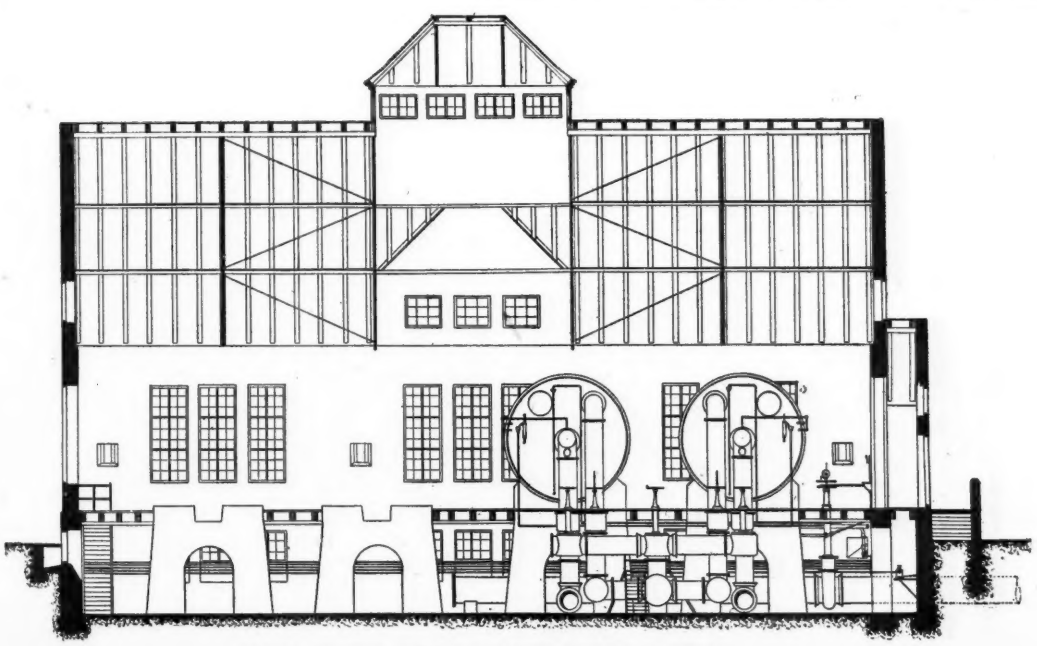
At the north end of the building there is a shed for the storage of new and spent purifying material. The mechanical equipment described suffices for discharging and recharging a purifying vessel with 390 cubic yards of material in a day-and-a-half. Twelve men are necessary for one day to discharge the vessel and spread out the spent material for revivification; and five men are required for half a day for refilling the vessel.

Station Meters.

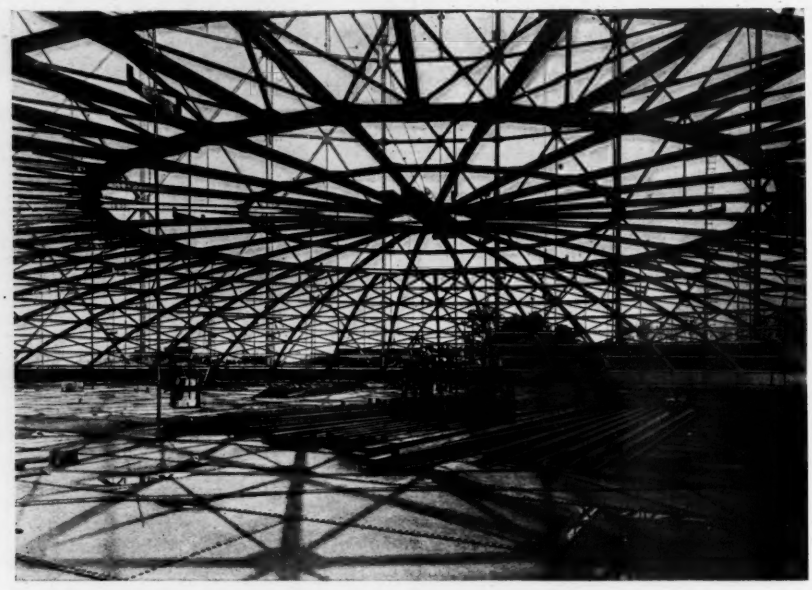
Two mains, 28 inches diameter, lead from the valve annex of the purifier house to the two station meters in the meter house. The connections are arranged so that one meter takes the gas from one set of purifiers; but provision is made for diverting the gas from one meter to the other in case of repairs. Each meter has a capacity of 141,260 cubic feet per hour; the capacity of the drum being 1325 cubic feet. The connections to each meter are 28 inches diameter. On the holder side of the meters are two Pintsch rapid-action valves. A vertical cross section is given of the meter house, showing the connections to the two meters and the space provided for an additional two meters when required.

Gasholder.

Only one gasholder of 2,625,000 cubic feet capacity has so far been provided. The tank has a flat bottom, and contains 875,000 gallons of water. The holder has three lifts; and the pressures thrown, according to the number of lifts in use, are 4·7, 5·5, and 6·7 inches respectively. The guide-framing, which has been made as simple and plain as possible, with a view to economy of maintenance, is 141 feet in height. The tank is 190 feet in diameter,



CROSS SECTION OF THE STATION-METER HOUSE.



CROWN OF THE GASHOLDER DURING CONSTRUCTION.

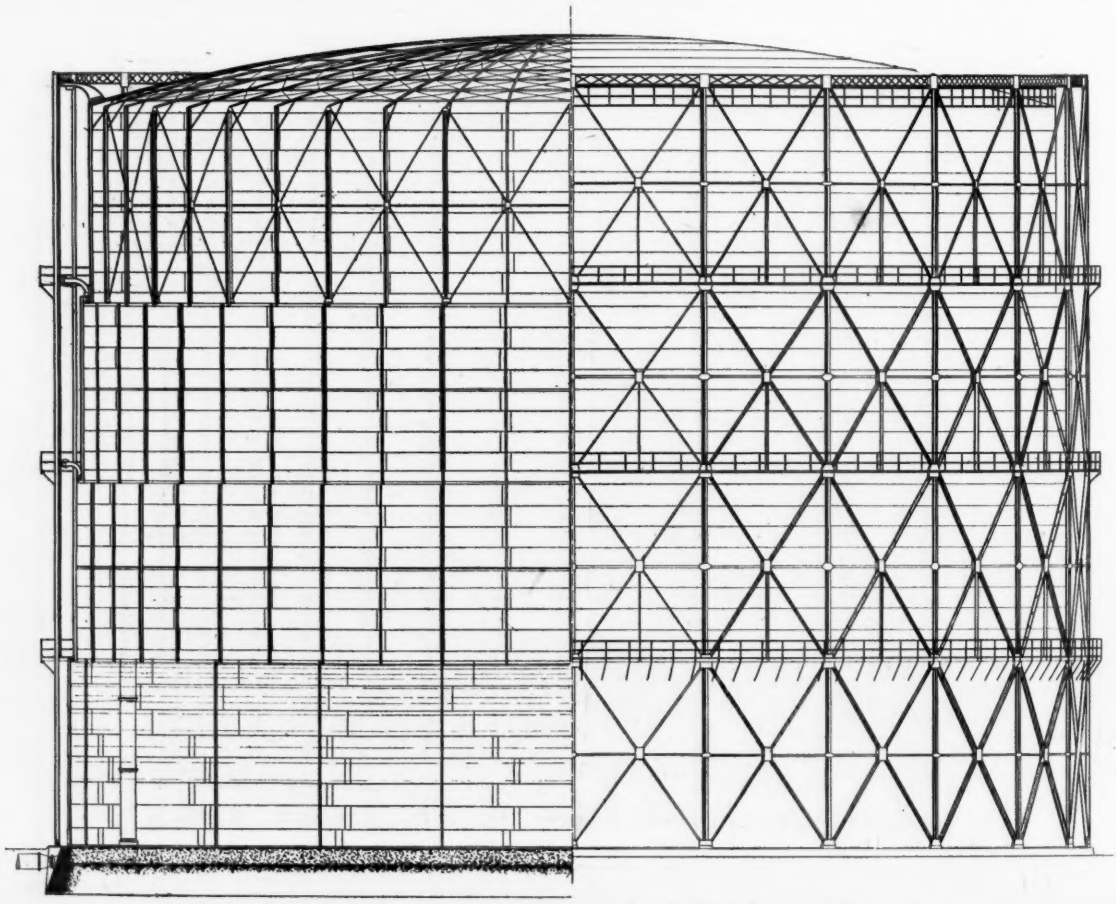
and its walls are carried on a 10 feet deep reinforced concrete ring. Inside this ring the bottom of the tank is of rammed ballast, covered by a 1·2 inch thick layer of asphalt. The crown of the holder, which is not trussed, is provided at its curb with tangential guide-rollers. The remaining lifts are radially guided. The inlet and outlet pipes of the holder are made accessible through sealing cups attached to the crown. A staircase is provided for reaching the galleries round each tier of the framing, and a vertical ladder is also provided to give access to the crown of the holder at any height.

Governor House.

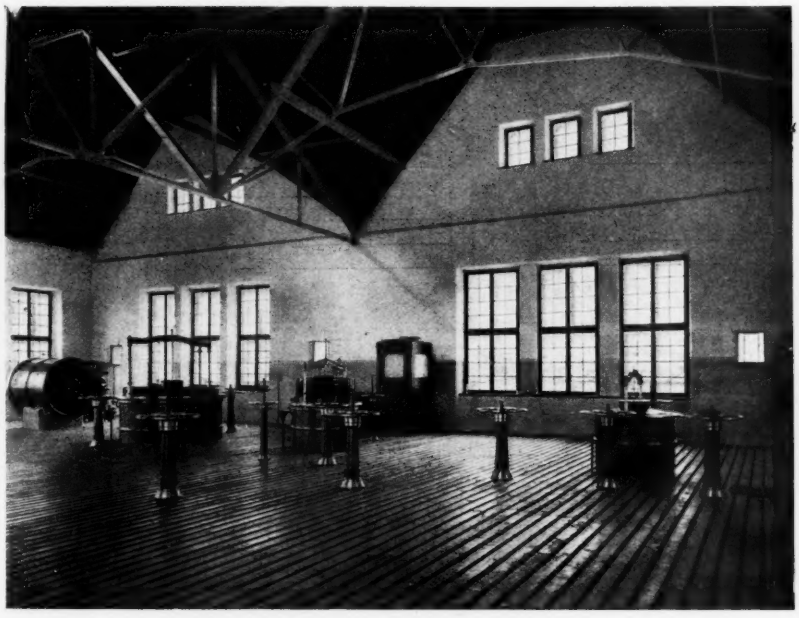
This is shown on one photograph. There is a Pintsch quick-action valve between the gasholder and the governors. A Gareis preliminary governor is provided, and has a small bell inside the large one, specially to take up the wave of pressure which occurs when the holder cups. From this governor the gas passes, according to the consumption for the time being, either into the small day governor having 16-inch connections, or into the large evening governor having 40-inch connections. The first serves for outputs up to 141,264 cubic feet per hour, and the latter up to 529,740 cubic feet per hour. The governors are operated from the apparatus house by oil being drawn from, or pumped into, the cups. The governors act with full precision until the gas is completely shut off. The gas consumed on the works is measured by a separate meter and controlled by a small governor. At present there is only one 48-inch main from the governor house to the town. It is intended ultimately to duplicate this, and to provide a high-pressure main. Gauges in the governor house record the pressure in the town and in the gasholder.

Elevated Tar and Liquor Tanks.

The elevated tanks for tar and liquor consist of three circular tanks, with convex crowns and bottoms, each of 81,400 gallons capacity. Above two of these tanks are larger ones of similar construction of 220,000 gallons capacity. One of the small tanks



ELEVATION AND VERTICAL SECTION OF THE GASHOLDER.



INTERIOR OF THE GOVERNOR HOUSE.

is used as a separating tank, the next small tank is used as a first tar tank, and the last small tank, which is in the open, is a first-liquor tank. From the first tar-tank, the tar is delivered by a steam-pump of 1100 gallons capacity per hour into one of the large tanks, and the liquor is transferred by a centrifugal pump of 13,200 gallons per hour capacity to the other large store tank. Two of the small tanks and the two large tanks are enclosed in towers as shown.

Experimental Works.

Between the apparatus house and the water tower an experimental works has been provided in connection with a setting of 13 retorts between the benches of carbonizing chambers. The gas from this setting is taken by a 12-inch main to the apparatus in the experimental works. Most of this apparatus has been derived from the demolished works in the Thalkirchnerstrasse. There are two water-tube condensers, a fan-exhauster, a governor, a tar-extractor, a scrubber, and a meter, of 17,660 cubic feet capacity per hour. Provision is made for measuring exactly in tanks the quantities of bye-products and scrubber water. This experimental plant is provided for testing different coals.

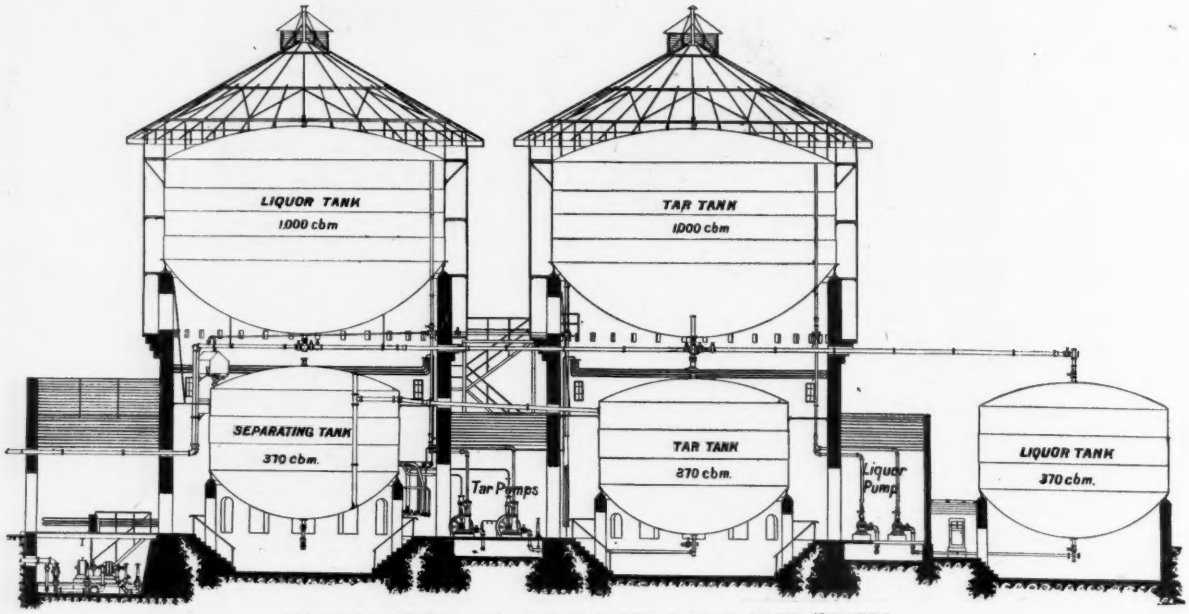
In the basement of the water-tower there is an automatic Junkers calorimeter, which records the calorific power of the gas produced in the experimental plant and in the ordinary works' plant. There is also a photometer room in the same basement. On the first floor of the water-tower are three experimental gas-holders of 35 cubic feet capacity, in which average samples of the gas being produced can be collected. Connections pass from these holders to the photometer and calorimeter.

Boilers.

The boiler installation, which is in the centre of the works, comprises four Lancashire boilers, each with 969 square feet of heating surface, and 32·3 square feet of grate area. The maximum working pressure is ten atmospheres. The boilers are 7·2 feet in diameter and 31·2 feet in length; and the flues are 32 to 36 inches diameter. Two of the boilers are equipped with forced draught under Kudliz grates and with Schwörer superheaters; the other two have automatic firing and wrought-iron Babcox superheaters. As experience has shown that with a forced draught much blown ash collects in the flue passages, an ash-collecting box has been inserted in the first flue at the back of the boiler, from which the ash is removed without interrupting the work of the boilers. In order to accommodate this arrangement, the flues and boilers were installed on the first floor of the boiler-house. The feed water is taken from a tank in the basement, by three horizontal steam-pumps on Voit's system, and passes through a Kennedy feed-water meter before being forced into boilers. Each of the pumps can meet the maximum requirements of three boilers. The feed water is softened by the lime-soda process. The ash and clinker from the boiler flues are thrown into vessels in front of the boilers which are drawn out on waggons running on the ground level.

The fuel is brought by waggons, after passing over an automatic

ELEVATED TAR AND LIQUOR TANK TOWERS.



VERTICAL SECTION OF THE TAR AND LIQUOR TANK TOWERS.

weighing-machine, to an elevator, from which it is distributed by a Balata band conveyor into the iron bunkers, of 5300 cubic feet capacity, which are in front of, and above, the boilers. The fuel passes by eight nozzles from these bunkers to the grates. The steam is collected—either saturated or superheated—in two independent steam-pipes, which take it to two welded wrought-iron distributors from which the steam-pipes to the works issue. Two steam-pipes go to the apparatus house, two to the bath-rooms, two to the gasholder for heating the seals, while others go to places where the consumption is smaller.

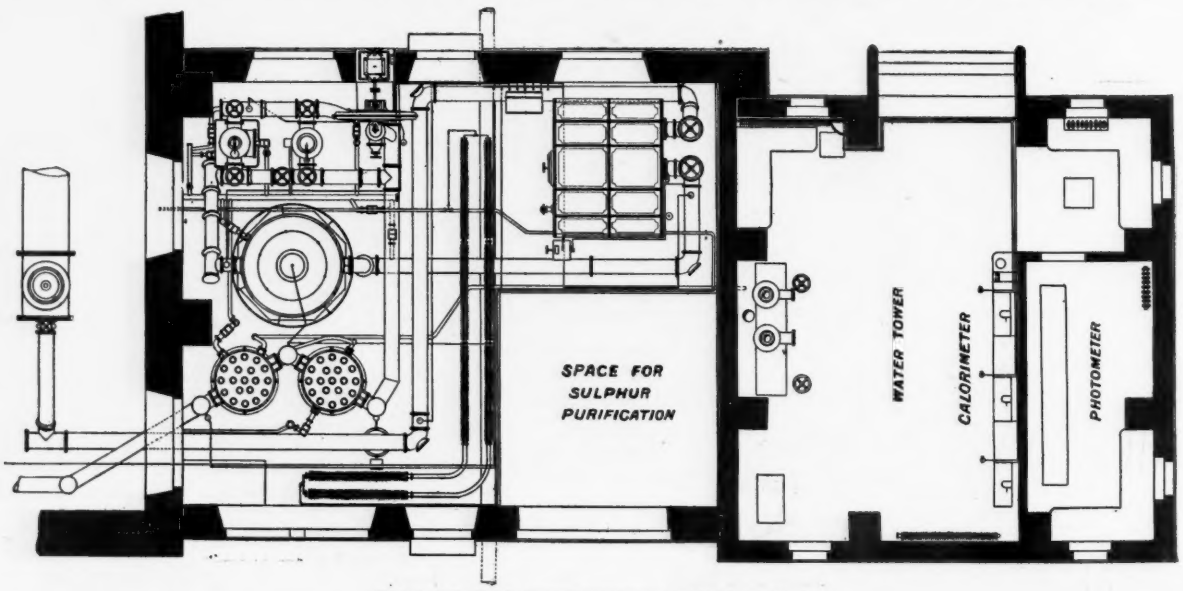
Electric Power Station.

The current required for driving the motors and for lighting on the works was calculated to be about 800 units in twelve hours. It was originally intended to provide a 200 H.P. gas-engine for day-time work, and a 50 H.P. gas-engine for night work, both coupled to continuous current generators, with a further 200 H.P. gas-engine as a reserve. Ultimately, however, it was arranged to connect the gas-works with the Corporation Electricity Works, and to enlarge and adapt the power plant at the gas-works so that it would serve in case of need as a reserve plant for the electricity works. The gas-works can now produce the current which it requires, or can draw it from the electricity works when the latter has a surplus of water power at its disposal. On the other hand, when there is an insufficiency of water power, the gas-works supplies current to the electricity works. The generating plant fitted at the gas-works consists of two gas-engines of 480 H.P. directly coupled to two generators for alternating current at 500 volts.

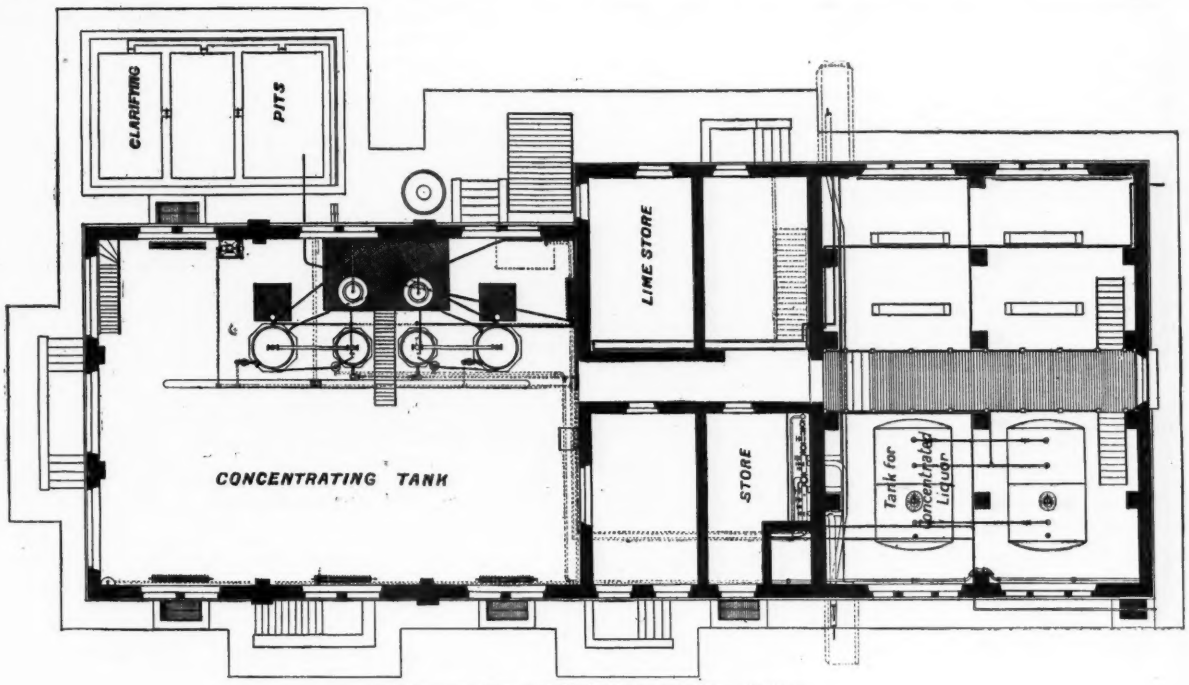
The two gas-engines are single acting, four-cycle, two twin-cylinder engines, with a cylinder diameter of 21 inches, and 26-inch stroke, provided with valves for the use of producer gas of 124 to 135 B.Th.U. per cubic foot gross calorific power. They were made by the "M.A.N." firm. Each develops 480 H.P. at 187 revolutions per minute. By the substitution of other valves, they can be used with coal gas. The fly-wheels are 10·8 feet diameter, and nearly 9 tons in weight. Should the calorific power of the producer gas fall below the figure named, an automatic regulator admits coal gas for enriching the producer gas to the standard calorific value. The engines are started with compressed air at 20 atmospheres. A Balcke condensing tower, with water circulation for a capacity of 11,000 to 13,200 gallons of water, cools the cooling water of the gas-engines from a temperature of about 113° to 63° Fahr. The consumption of cooling water is thus reduced from 8·8 to 0·88 gallons per horse-power-hour, and only about one-tenth the quantity of scale is deposited. Four centrifugal pumps, coupled in pairs direct with electro-motors, pump the warm water into the cooling tower, and the cooled water from the tank beneath the cooling tower into a tank above the gas-engines. A 10-ton travelling crane, with hand gear, is provided for moving the plant as required. There is an oil-filtration plant for filtering the used oil for return to the engines.

Producers.

The producer gas required is obtained from four suction producers consuming coke breeze, made by the "M. A. N." firm. The fuel is fed through an air-locked conical hopper to the proper height in the producer. The grate is a central conical step grate. Four towers are provided in the shell of the producer for cleaning. The evaporators for providing the steam required for gas-making are arranged as vertical tubular boilers heated by the hot producer gas leaving the producers. The gas is first cleansed by passing upwards through a scrubber packed with clinker continuously sprinkled with water, whereby the greater part of the



PLAN OF THE EXPERIMENTAL TEST PLANT.



PLAN OF THE AMMONIACAL LIQUOR PLANT.

dust is removed. Exhausters are used to overcome the resistance of the finely-divided fuel used in the producers, in order that gas may be made at a sufficiently rapid rate; and these exhausters are sprayed with water, which serves for the further cleansing of the gas.

Water-separators and tar-extractors are inserted between the exhausters and dry purifiers. The tar is of a particularly viscous character; and the drum of the extractor (of the Pelouze-Audouin type) is therefore disposed horizontally, and is rotated. The extraction of the tar is facilitated by the introduction of tar from the carbonizing chambers. The gas passes from the tar-extractors to dry purifiers packed with sawdust, which remove the rest of the moisture and dusty impurities. The fuel for the producers is brought by hopper waggons, opening at the bottom, of 18 cubic feet capacity, on overhead rails from bunkers in the boiler-house. It is weighed *en route* by an automatic weighing machine. The producers are fully clinkered and cleaned once in two to three months. The use of the exhauster keeps the ash and clinker sufficiently porous for the rotation of the step-grate to loosen the clinker from the walls of the producer and discharge it into the pan beneath the grate. The producers require very little attention; one man per shift being all that is necessary in full work.

Works' Water Supply.

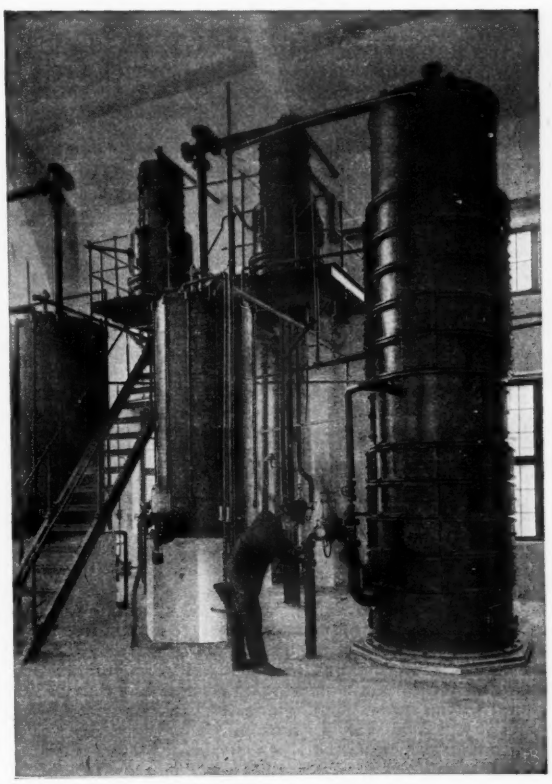
The water supply for the works is pumped by two high-pressure centrifugal pumps, each of 22,000 gallons per hour capacity, from a well 6 ft. 6 in. diameter on the north side of the works into a reservoir of 26,400 gallons capacity at the top of the water-tower. An ample supply of water of satisfactory quality is obtained from the well at a depth of 10 ft. 6 in. to 14 ft. 9 in. below the ground level of the works. This water is used for condensing, quenching of coke, &c. The effluent water from the condensers in the apparatus house passes into a reinforced concrete tank in the basement of the water-tower and is pumped thence into a second tank in the water-tower of 19,800 gallons capacity, from which it is, for the sake of economy, used for coke quenching and for feeding the boilers and evaporators of the producers. The works are connected by a 6-inch main with the town water supply system, in order that this supply may be available in case of interruption of the works' supply. The drinking water taps and the fire hydrants on the works are also supplied from this main.

Drainage System.

The waste water from the gas-making and liquor plant and the works' sewage are passed into a reinforced concrete pit of 19,800 gallons capacity, from which two electric centrifugal pumps, of 22,000 gallons per hour capacity, force the whole into a drain connected with the town sewers.

Ammonia Recovery Plant.

The crude gas liquor from the elevated tank, of a strength of 6·9 oz. to 7·4 oz. total ammonia, is purified and concentrated in plant supplied by Messrs. Pintsch to a strength of 110 oz. The crude liquor passes first through a ball cock and a regulating tap, which control the rate of flow, to a tipping vessel, which has a counter regulating the quantity of liquor passed, and divides the liquor into two streams. One of these streams passes to the ammonia receiver of the carbonic acid extractor, thence into a preliminary heater, in which it is heated by the spent liquor to 190° Fahr., and so to the hot chamber of the carbonic acid liberator, in which the temperature is raised by waste steam to about 198° Fahr. The other stream of crude liquor is then mixed with it, and the two pass, at a temperature of about 162° Fahr., into the ammonia distillation column. At the temperature of 198° Fahr., ammonia, carbonic acid, sulphuretted hydrogen, and other gases are liberated; but the ammonia is again completely absorbed by the cold liquor subsequently introduced, while the rest of the gases escape. The admission of steam to the carbonic acid liberator is regulated so that an almost uniform temperature is maintained in the latter.



THE LIQUOR STILLS.

The liquor is distilled in the column by means of steam admitted at the base, and concentrated liquor is produced in this way. The greater part of the ammonia of the crude liquor is thus volatilized; but the fixed ammonia has to be liberated by means of milk of lime in the upper sections of the column. The milk of lime is prepared in the middle portion of the column of a strength of 1 : 10, and is distributed by a cataract pump into two columns alternately. The spent liquor passes into a tank below, from

which it flows uniformly through the preliminary liquor heater, which it leaves at a temperature of 122° Fahr., and containing not more than 2·1 grains of ammonia per gallon. The spent liquor finally passes in series through three clarifying pits. The gaseous ammonia from the distillation column is condensed by more or less fresh water into concentrated liquor of the desired strength. This liquor runs into two wrought-iron storage tanks, each of 7700 gallons capacity, from which tank-waggons are filled by air pressure.

Steam and Current Distribution.

Two steam-pipes lead from the boiler plant to the apparatus house, where they are connected. One steam-pipe goes thence to the retort-house, and another to the tar and liquor plant, whence it passes to the liquor-concentrating plant and the purifiers. The exhaust steam from the engines, being utilized for heating, is passed through exhaust-steam pipes, which, in case of need, can be utilized as high-pressure steam-pipes. A steam-pipe is also carried to the meter-house, and thence to the exhauster and governor house. Small steam-pipes are carried to the store and the baths. The temperature at which the gas enters the apparatus is controlled, so that no steam heating of the apparatus house is necessary. The tar and liquor tanks, the liquor concentrating plant, and the revivifying floor of the revivifying house, are ordinarily heated with exhaust steam; but live steam can be introduced through a reducing valve in case of need. The seals of the purifiers can be heated by steam when necessary; and the meter and governor house are kept free from frost by high-pressure steam-pipes. The gasholder cups are heated by injectors which are connected with the steam supply by seamless flexible metallic tubing. The stores, workshops, canteen, and baths are heated by low-pressure steam from the exhaust steam pipe, or, through reducing valves, from the high-pressure steam-pipes.

Each electric generator develops 320 kilowatts at a tension of 500 volts and 50 alternations. The switch room, in addition to the usual switches, contains resistances and switches for connecting the works' generators with the works' conductors or with transformers for the Corporation electricity works. Transformers reduce the current from the Corporation conductors from 5000 to 500 volts, and raise the current from 500 to 5000 volts when the electricity works is taking current from the gas-works plant. The works conductors are connected to a main switchboard, and later to separate switchboards for the power and lighting supplies. For power, duplicate conductors are carried to all the important places where current is required. The motors work at 500 volts, except in the shops, where, in view of greater safety, the tension is reduced by a 10 kilowatt transformer from 500 to 110 volts. In order to allocate the expenditure on power and lighting, separate meters are installed on the different conductors. For the lighting circuit, the current is reduced from 500 to 110 volts. The use of comparatively high tension alternating current has necessitated careful installation and protection of motors, wheels, &c.; dust-tight casings having been provided for them throughout.

(To be concluded.)

LOCATION OF HIDDEN PIPES.

Application of the Wireless Principle.

In a previous issue of the "Journal," reference was made to a portable apparatus designed by Messrs. Mansfield and Co. for ascertaining the existence of underground streams or bodies of water at depths up to 3500 feet. These instruments have been tried in many parts of the world, and excellent testimony has been borne to their efficiency. Mr. Edwin A. Mansfield, of New Brighton, Cheshire, was in Canada last summer in connection with his water-finder; and while so engaged he had his attention directed to a similar appliance for discovering pipes which had been buried and forgotten. He put himself in communication with the suppliers of the instrument; and he has now the sale of it in the Eastern Hemisphere. It is called the "Wireless Pipe Locator;" and it is claimed for it that it will show the position of any concealed or underground gas, water, steam, or other pipe, whether covered with concrete, earth, boards, snow, or ice. It is shown in the accompanying illustrations.

The "Locator" consists of a special form of vibrator and induction coil mounted in an oak box provided with space for the necessary battery, as shown in fig. 1. This part of the apparatus is designed to produce the necessary current on the lost pipe. A specially constructed detector coil and receiver is provided for tracing the circuit. The operation of the instrument is very simple; and any average workman can use it. It is well known that a conductor carrying an electric current is surrounded by an electric field. If a coil of proper construction is brought within this field, a current will be induced in the coil; and if this is connected to a telephone receiver, the effect will be manifest by a tone produced therein. The nearer the coil is brought to the conductor, the louder will be the tone. The "Locator" has been designed to produce a current of such strength that, if connected to a pipe as the conductor, the operator may trace the pipe by means of the detector coil and receiver.

To use the instrument, all that has to be done is to attach the two outgoing terminals to the two ends or positions between which the hidden pipe or main is known to exist, and all between these

Fig. 1.

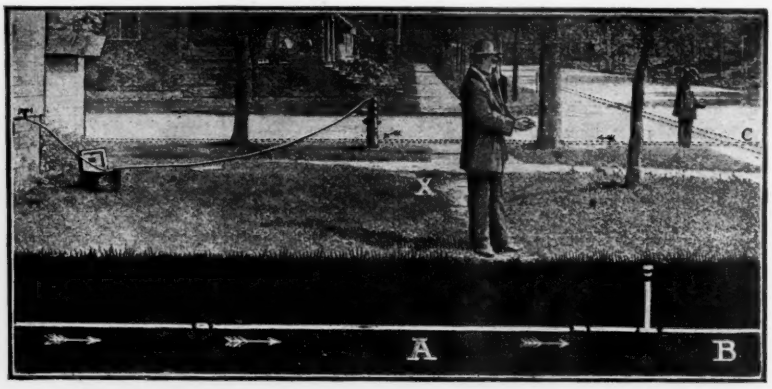


Fig. 2.

points is in such a state of electrical agitation that the coil of wire is readily affected by the magnetic field produced by the interrupted current supplied by the batteries. The telephone receiver, being attached to the ends of the coil of wire, is set to work by the induced current in the coil; and the result is a buzz, which is strongest in the nearest position to the main or pipe. There is no difficulty in following the noise if the operator starts investigating from the position where the instrument is connected.

In figs. 2 and 3 the method of locating a lost pipe is shown. A B (fig. 2) are the service-pipe, of iron and lead; also the stop-box or cut-off, covered by grass. C is the main in the street; and X is the field. Suppose it is not known to which main the service-pipe is attached to supply the house on the corner lot. The circuit is formed by connecting the instrument—one side to the sill cock, and the other to the fire hydrant. On closing the battery circuit, the current will flow as shown by the arrows. The man in the foreground can hear the tone anywhere in the field formed by the pipes and the wires; but in passing over the service-pipe or main an abrupt change in the tone is noticeable.

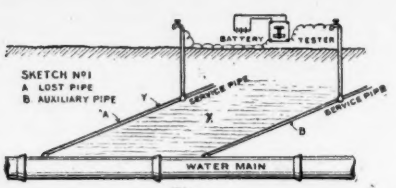


Fig. 3.

By stopping where this change takes place, the operator will be standing nearly directly over the pipe.

Lead or iron pipes can be traced through a building without any disturbance of plaster, boards, or anything else; and, as already intimated, there need no longer be any opening of roads to trace a main or a service-pipe. These advantages should commend the "Locator," which is in use by a large number of gas and water companies in the United States, to the attention of gas and water engineers on this side the Atlantic.

NIGHT PHOTOGRAPHY—see p. 100.

Photo. by J. H. Avery and Co.

LIGHTING BY GAS OF ST. SAVIOUR'S CHURCH, ST. GEORGE'S SQUARE, PIMLICO.

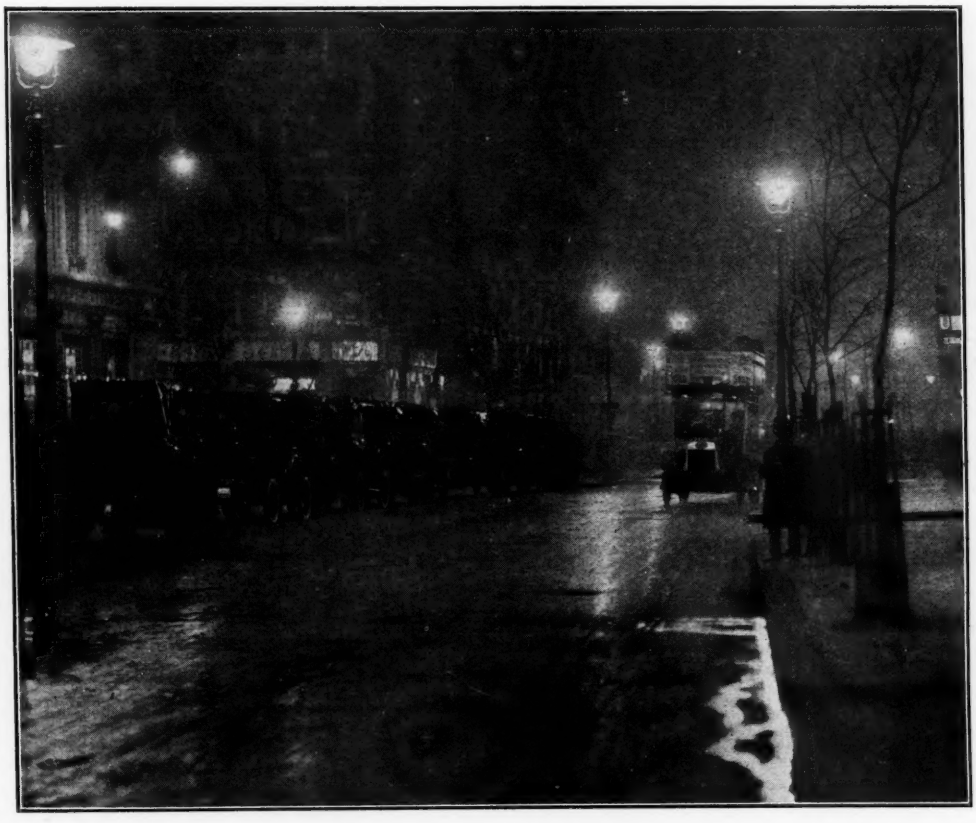


Photo. by J. H. Avery and Co.

A NIGHT SCENE IN KINGSWAY UNDER HIGH-PRESSURE GAS LIGHTING.

NIGHT PHOTOGRAPHY.

THE most difficult form of photographic work of which we know is the taking of night scenes by artificial light, particularly with the view of conveying to the eye examining the resulting picture the effects of the lighting. We have seen some most unhappy results of night work of this kind—results that are as wide from truth as night is from day. Outdoors and indoors, too, the difficulties of correct exposures according to the environing conditions are many; and to reproduce a scene, with its light and shade, in faithful pictorial form is a matter requiring a cultivated skill. One result of difficulties surrounding this class of work is that one often comes across what a trained eye recognizes as pictures produced from "touched-up" negatives. The blemished negative and the subsequent handwork yield a very crude presentment of the actual view at night time under artificial light.

Attention has been directed to the night photography of Messrs. John H. Avery and Co., of No. 40, Hillmarton Road, London, N., who have what is so necessary for good results—special experience of both architectural and artificial light photography. One wants to show in photographs with which the suppliers of artificial light are concerned not only a magnificent display of lights, but that the lights are performing the duty for which they were destined. Messrs. Avery and Co. have sent us some samples of their photographic work (of which anyone can have copies upon application to them); and they illustrate the special study that is made by them of the light effects upon the surroundings. There is a street night scene in London in which the details of the street stand out, by the light of the Keith high-pressure gas-lamps, with remarkable clearness. There is a view of a church interior; and the architectural details, under the soft illumination, are clearly portrayed right away to the reredos. The same in a large machine room of a dressmaking establishment; and again in a crowded shop window. None of these photographs have been "faked;" and the untouched negatives, Messrs. Avery tell us, may be seen by anyone really interested. In a communication on the subject, they remark: "The elimination of halation has become such an obsession to most photographers that everything else is sacrificed to it; and it is a common thing to see photographs with no impression of light at all. Our method is to see to the light effect first, letting halation come as an important but secondary consideration." The work of the firm certainly speaks for itself—see p. 99.

THE MANUFACTURE OF MANTLES FOR INCANDESCENT GAS LIGHTING.

By Dr. C. RICHARD BÖHM, of Berlin.

(*Continued from p.* 35.)

BURNING-OFF THE MANTLE.

SHOULD, as is frequently the case, the customer wish his trade-mark to appear on the mantle, a solution according to the following formula may be used for stamping it on the mantle while still in its stocking form:—

1000g. chemically pure nitrate of didymium.
200g. glycerine.
25g. methyl blue.
300g. alcohol, 96 per cent.
500Kg. distilled water.

Before the burning-off proper—that is, the burning-out of the organic matter—can take place, each stocking has to be pulled over a wooden shaper, which is slightly conical towards the top; the latter part being rounded off and having a small protrusion in the middle for the purpose of allowing a better adjustment of the stocking when being pulled on the block. For the drawing over the block and smoothing-down of the stocking, clean hands are absolutely imperative. Care should be taken that the stocking is not only even at the bottom, but also that no creases remain, and that the mesh-work is, as far as possible, uniform—*i.e.*, that the meshes are not stretched out too much in some places while in others they form, as it were, a solid whole. The shaping being completed, the stocking is taken hold of by the loop (by means of a hook) and lifted off the block, whereupon the hook, with the mantle suspended from it, is fixed into a hole which is made in either a piece of board, the working table, or bench, or else in the foot of the wood block itself. The mantle is now ready for burning-off, to which end the flame of a bunsen burner is applied to its head. Were the burning-off to be started at the bottom of the mantle, the latter would during the process shrink to such an extent as to be rendered useless. With ordinary inverted mantles, it is only necessary to pull the stocking straight, when the subsequent shaping may be left to the force of the gas.

It will be seen from the foregoing that the burning-off is a very simple process. The bunsen flame playing round the head of the stocking presently causes a burning circle to appear, which slowly travels downward to the lower end of the mantle. When the circle has reached about half-way down the stocking, the action of the bunsen flame should be stopped, and the burning-off allowed to continue on its own accord. Towards the end of the process, the oxide skeleton usually shows a disposition to close at the bottom. This can be prevented by keeping the walls of the mantle apart by means of two clean glass rods, or by placing the stockings on a wire frame prior to burning them off.

In the burning-off process, the organic matter—*i.e.*, the web—is almost entirely removed; while the nitrates of thorium and cerium are converted into their corresponding oxides, which are now the substances of which the soft and easily breakable mantle consist, though the texture of the web remains plainly visible. In order to expedite the burning-off process, a score of mantles are put on hooks and fixed into holes made in a wide ledge, in two rows of ten each, whereupon one mantle after another is ignited from the top by means of a bunsen burner. A further saving in time may be effected by placing the ledge, with the mantles arranged at either side, between two rows of small gas-jets—each row composed of a length of gas-pipe furnished with lateral holes. The flames proceeding from these holes are directed straight against the mantle-heads, which in this way can automatically be set alight. A similar arrangement for burning-off incandescent mantles is still in use.

The burner used for shaping and hardening is none other than a bunsen burner, which, for the purpose of spreading out the flame, is furnished at the top with either a wire gauze or else a steel head provided with holes or slits. As the pressure produced by means of a hand blower is very weak, compressors are now used instead. Care should be taken not to exceed a pressure of three-quarter atmosphere, as otherwise there may be danger, owing to the bursting of tubes, &c. For this reason, the custom has sprung up of late to compress not the gas but the air, whereby even greater economy may be effected. With a pressure of only half atmosphere, a flame of about 80 inches in length can be produced from a ½-inch gas-pipe, which might be the cause of very serious accidents. Where a pressure of from a quarter to half atmosphere only is employed, but little saving is possible; whereas the economy effected by using from half to one atmosphere pressure amounts already to 20 per cent.

In the early days of the industry, the pressure employed for burning-off mantles amounted to only a quarter atmosphere. When the pressure was increased to half or even three-quarter atmosphere, the old type of burners became useless, on account of the great heat developed by the flame fusing the brass wire gauzes and burner-heads. For burning-off by machinery, the old burner had to be replaced by one of different proportions. Moreover, nickle-steel had now to be used for the wire gauze, which also had to be slightly rounded off, so as to allow the outer air to get to it for cooling purposes. In spite of this, the wear of the burners with gauze tops is much greater than that of those with slit heads, which are now almost universally employed for burning-off by machinery.

The compressed gas burner for inverted mantles is, in principle as well as in its dimensions, identical with the one employed for upright mantles. At the outset, the inverted mantles used to be burnt-off by hand. Machines were, however, soon introduced for the purpose. Hand labour is even at the present time employed, though rarely, for burning-off upright mantles—*i.e.*, in small factories, or by large makers for special kinds of mantles. But as regards inverted mantles, there is little doubt that the burning-off is, without exception, performed by machinery.

The stocking, after having been turned to ashes, is first shaped on the compressed gas flame under a reduced pressure of (say) from 2 to 2½-inch water column, which is obtained by partly closing the burner-tap. For the purpose of shaping, the mantle is guided up to its head over the burner tube and shaped from the head downward. The mantle is now hardened by being, at increased pressure, repeatedly moved upwards and downwards for the space of from 1½ to 15 minutes, according to the size and the strength of the web. The maximum of 15 minutes applies to very large mantles—for instance, those used for lighthouse purposes. For the protection of the operative against the extremely brilliant light produced in this process, use should be made of dark glasses, or of a dark glass-screen placed in front of the flame.

While mantles of cotton and ramie are first burnt-off by means of special burners and then shaped and hardened on high-pressure burners, it has hitherto been found impossible to adopt this course in the case of mantles made from artificial silk. In the burning-off of the artificial fabric, this drawback makes itself felt, that, as soon as the salts are converted into oxides, the artificial threads do not remain stretched and uniform as regards length, as is the case with the natural threads of cotton and ramie, but draw in and become entangled—thus rendering the subsequent process of shaping and hardening by compressed gas impossible.

Plaissetty, who for some considerable time had been engaged on the problem of the artificial silk mantle, and who was the first

to manufacture this kind of mantle, with the aid of the ammonia process, soon realized that the burning-off, the shaping, and the hardening must be performed in a single operation. The artificial silk stocking, after having been impregnated and shaped-over the wood block, is slipped over a guiding tube in such a fashion that only the head of the mantle protrudes over the burner-top. The outer diameter of the tube should correspond to the width which the finished mantle is required to possess. Thereupon, the compressed gas is let into the burner and lit, whereby the burning-off process is initiated. This process completed, the mantle is slowly moved upwards along the guiding tube, either by hand or else by mechanical means, till its lower end reaches the burner-head.

The statement made on page 142 of my book "Das Gasglühlicht," to the effect that the burning-off of incandescent mantles by mechanical means is a thing to be avoided, was, at the time of publication—viz., 1904-05—entirely justified; for up to that date the efforts to construct a serviceable machine for this purpose had practically yielded no results. Soon afterwards, however, several quite useful burning-off machines were placed on the market, as a result of the stimulus created by I. Janz' machine; but some time had still to elapse before the mantle makers fully adapted themselves to mechanical modes of manufacture.

If formerly makers held the view that, as regards the burning-off process, individual skill and manual labour could not be dispensed with in favour of mechanical means of working, they now seem to be of opinion that only goods of secondary quality could be produced by machinery. Acting on this supposition, they continued to burn-off the first quality mantles by hand. Taking into consideration the lack of uniformity which already exists in the raw web, either on account of differences in the thickness of the yarn or through an uneven treatment in washing—faults which show themselves only in burning-off—and, further, taking into consideration that, owing to uneven treatment while impregnating the lengths of webs, other defects may result which in the ordinary way are not apparent, it will be easy to understand that all such irregularities show themselves more plainly under the mechanical burning-off process. For with a machine all mantles are treated alike; while in burning-off by hand, the operator will, to a large extent, unconsciously equalize any existing unevenness.

As soon, however, as the mechanical burning-off system had been decided upon, all these facts had to be taken into account. The raw web and its impregnation had now to be dealt with in a much more careful fashion than was formerly the case—in other words, the preparation of the mantle in its stocking state had to be carried out with an eye to much greater uniformity. In order to prevent the stocking from shrinking at the lower end, and thus closing itself after it had been burned-off, glass cones of a somewhat greater width were employed on which to shape them, while more attention was also paid to properly regulating the temperature for the drying process. Originally, mantles were burned-off before being placed on the machine for shaping and hardening. Soon, however, the considerable amount of waste which of necessity accompanies the conveying and putting on the machine of the highly breakable soft mantles in their burnt-off state, made it imperative that the burning-off should also be performed by machinery.

Burning-off Machines.

A modern burning-off machine is constructed as follows: In a stable iron frame, which, as a protection against draught, is generally closed in at the sides by means of asbestos sheets, one or two bars, fitted with ten or more burners for compressed gas, are arranged in such a fashion as to be able to move up and down. The burning-off jets, which nowadays are used also for hardening the heads from the outside, and which can be turned back like the carrier of a typewriter, consist either of round-burners or else of four to eight small flames, which, emanating from two parallel gas-tubes, are arranged in such a way as to concentrate round the mantle-head. We therefore have to distinguish between an upper row of burning-off jets and a lower row of high-pressure burners.

The mantles are, by means of hooks, suspended from rods or bars. In case of the latter, which are fixed parts of the machines, the mantles are put on and taken off one by one, for which purpose a special hooking rod is generally employed. The rods, on the other hand, are movable, and can therefore be placed in the machine with the mantles suspended from them; while, after the shaping and hardening process has been completed, the whole charge of mantles can with one grip be removed from the machine. Just as the bars differ from the rods, the hooks used with the one system are not the same as those employed with the other. Consequently, the parts are not interchangeable so far as the two types of machine are concerned.

The up-and-down movement of the row of compressed gas-burners is effected either by means of a lever worked by hand or else mechanically by a planetary motion. While the operator works the lever or starts the machine with the right hand, she uses the left to regulate the gas supply, and, consequently, the flames of the pressure burners. However, before the machine is set in motion, the protecting screen in the front of it is lowered. It consists of two panes of glass—a white one to keep off the heat, and a blue one to protect the eyes from glare. In the burning-off process fumes of an unpleasant odour are produced which, as a rule, are removed, by means of ventilators, through a roof-shaped funnel-box fixed on top of the frame of the machine.

The machine for the burning-off of inverted mantles differs only slightly in construction from that for upright mantles. The mantles are placed upon small exchangeable saucers, made of tin, and stamped in accordance with the varying shape of the rings employed. The saucers, with the mantles on them, are then placed in the burning-off frame, composed of two parallel angle bars, where they are burned-off, shaped, hardened, and collodionized. The use of this type of machine renders a special device for burning-off unnecessary, as the pressure burners perform this function along with the rest of the process. As the machine measures only from 40 to 60 inches, and as its capacity is about four times that of a manual operative, it is evident that, by adopting the mechanical process, a saving not only in wages but also of space can be effected. Now that the usefulness of burning-off machines has been established, they have been adopted in most mantle factories of any standing. It may, therefore, be asserted that all objections which in years gone by were raised against the employment of mechanical means of manufacture have been rendered invalid, thanks to the ingenious construction of modern machines. The fact of them being taken up to such an extent that a special industry has already sprung up for their manufacture, is the best proof of the value of the machines.

In cases where each operative works only one machine with from ten to twelve burners, she has sufficient time to shape the stockings on the block. She requires, however, an assistant as soon as she operates two machines. As compared with manual labour, the capacity of a burning-off machine is very great. For, while a skilled hand is only able to shape and harden from 250 to 400 mantles of first, or from 500 to 600 of second quality, per day of ten working hours, an operator, using a machine with ten or twelve burners on either "ramp," can in the same time turn out from 1500 to 1800 upright mantles, or from 1000 to 1200 of the inverted type. An assistant, who nowadays is only required where the manual process still prevails, is able to burn-off from 4000 to 5000 stockings per day, ready for shaping and hardening. Where one operative works two machines of ten or twelve burners each, an extra hand is required for shaping the stockings on the block. The weekly wages earned by the female workers are, on the average, 15 to 18 marks in the case of machine operatives; while those employed in burning-off by hand receive 18 to 21 marks. Girls doing the preparatory work receive only 12 marks.

I may mention at this juncture that the description given above as regards the mechanical burning-off process is by no means to be regarded in the light of a hard-and-fast rule. Practical experience has shown that, while one operative may finish a mantle of standard size in three turns—each consisting of an upward and a downward movement—by the application of considerable gas pressure, another operative prefers double the number of turns at a pressure reduced proportionately. Other features to be considered by the manufacturer are the nature of the web and the impregnation, both of which vary largely owing to the numerous special mantles in vogue.

Moreover, the varying heating quality and pressure of the gas have to be taken into consideration. All these are points of great importance, especially as regards the burning-off by machinery process, as they give the cue to the operative, who, by first burning off a few trial mantles, makes the necessary observations by which the further work has to be guided. This work is almost mechanical; for the operative is now able to set the specially-provided clock according to the observations which she has previously made. This clock, which is fixed by the side of the machine and fitted with a time bell, has its face divided into segments of different colour, corresponding to the various movements of the burners. The rods or carriers, which, as a rule, are arranged for holding ten mantles at a time, are suspended in box-like or frame-like carrying arrangements.

In order to be still more independent of manual labour, efforts have been made in the direction of producing mantles from beginning to end entirely on machines. Müller and Bonnet were probably the first to hit upon this idea—taking out copious patents covering the principles of the invention. A machine brought out by Robin, which was based on the principles of this invention, led to important patent litigation, which was only recently brought to an end. A number of Robin machines, which for several years were employed with highly satisfactory results at Mr. Richard Feuer's works in Berlin, had to be taken out on account of the pending litigation for the infringement of patent rights. At all events, it has now been proved that Müller's bold idea was of practical value; for in Germany alone many millions of mantles were, within the space of a few years, manufactured on the Robin machines.

(To be concluded.)

Patents in the Past Year.—Applications for letters patent for inventions showed an increase of 718 during the past year. The numbers for the last three years were: 1910, 30,403; 1911, 29,400; 1912, 30,118. Rather more than one-third of these were limited to provisional protection. Though precise figures are unobtainable, it is calculated by Messrs. Stanley Popplewell and Co. that among the most popular subjects of invention during the past year have been internal combustion engines. Other favourite subjects were furnaces and kilns, stoves, and fireplaces. The staff of the Patent Office numbers nearly 700. Its gross income from patent fees is between £250,000 and £300,000, leaving an annual surplus of upwards of £182,500, including the site.

TECHNICAL GAS ANALYSIS.

THE ANALYSIS OF GASES AS APPLIED AND USED IN TECHNICAL LABORATORIES.

By P. C. Balcon, of Birmingham.

[A Paper read before the Midland Junior Gas Association, Jan. 11.]

I have taken the liberty of altering the original title of my paper, as it did not seem to me to sufficiently convey what my intentions were in presenting this contribution. For thus trespassing, I hope you will forgive me. In looking through our "Transactions," I find we are singularly lacking in papers which I might call, to some extent, of the tutorial type. By this, I mean papers which are confined to the purely scientific side of the industry. It seems to me that while, of course, we should mainly have laid before us papers of (shall I say?) commercial value, yet we must certainly keep pace with everything that makes for more accurate control of our manufacture. Papers of this class are such as that of Dr. W. B. Davidson, on "Measuring, Testing, and Recording," and by Mr. G. C. Pearson, on "Pyrometry." I had the honour to present a paper on "Calorimetry" a few sessions back; and I hope you will regard the present paper as something in the nature of a sequel to that. I propose to deal to-day with the "Analysis of Gases as Applied and Used in Technical Laboratories."

Gas Analysis over Water.

The apparatus almost universally employed is Hempel's, using water as a confining medium. This consists of two long tubes, one graduated in 100 c.c., each divided into five parts, and the other, which is used for levelling, quite plain. The gases which constitute the mixture called coal gas, or, of course, any mixture of gases, are absorbed in pipettes of the form everyone is acquainted with—*i.e.*, two or more bulbs to contain the absorbing solution; the connection between the measuring burette and the absorption pipette being made with a piece of glass capillary tubing having two right-angle bends.

This apparatus of Hempel's, while being rapid, is certainly not capable of being read with comparative accuracy. The divisions on the measuring tube are 0·2 c.c., but can be read to 0·1 c.c., making the accuracy of the instrument of the order of 0·2 c.c. As it is usually employed, the apparatus is not water-jacketed. This is, of course, a great disadvantage in working, as the presence of the operator and the handling of the tubes can easily make a considerable difference to the temperature of the gas contained in the pipettes and burettes, and so affect the volume.

Another great disadvantage of the Hempel apparatus is its lack of portability. This has been to some extent got over with the Orsat apparatus, which is very portable, but possesses many very obvious disadvantages and inaccuracies. For instance, it is impossible to shake the Orsat pipette, which is practically fixed in position; and this means that the gas has to be passed in and out of the pipette a large number of times. Again, the long length of capillary tubes and the number of cocks make the possibility of error very great. Another point is the fact that the pipettes are filled with a large number of glass tubes. If by any chance one of these is shifted centrally over the outlet-pipe, it acts as a syphon, and the gas will pass down the tube and bubble out through the solution.

All these objections and difficulties have been got over in the little apparatus designed by Dr. Davidson, which replaced Hempel and Orsat in the Birmingham laboratories more than six years ago. You will see its details from the sketch. Fig. 1 gives a good idea of the apparatus.

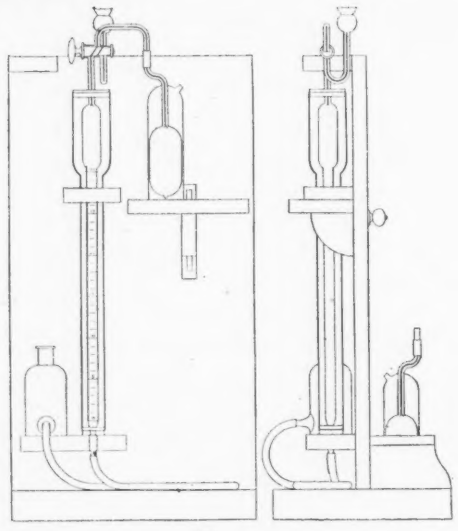


Fig. 1.

For works purposes, and in apparatus in which water is used as a confining medium, it is not usual to attempt to estimate anything beyond carbon monoxide—*i.e.*, H_2S, CO_2, unsaturated hydrocarbon, O_2, and CO—so advantage is taken of this in graduating the stem. Usually with coal gases the absorbable constituents do not exceed 20 per cent.; so that the bulb of the apparatus is arranged to hold 80 c.c., and the tube, a very narrow one, is graduated in 20 c.c. For carburetted water gas, it is necessary to have more graduations upon the tube—say, 50 c.c. The whole of the bulb and measuring tube is immersed in a water-jacket, and is fixed upon the very convenient stand, which is shown in the diagram.

The pipette for use with this apparatus is a modification of the Hempel pipette; and its construction is particularly simple. The gas is passed through a capillary tube into the inner bulb, which is sealed into an outer cylinder. The gas forces the solution into the outer bulb, and the gas remains in the inner bulb in contact with the solution. Apart from the great advantages of portability and ease of handling, the gas comes in contact with only a very small quantity of solution—thus in some measure preventing solution of the gas. Again, it is very easy, if necessary, to shake the pipette to cause intimate contact with the solution. The stand is so arranged that sufficient pipettes for the analysis can be carried at the back, and are easily got at; the time occupied in changing the pipettes being sufficient to give the measuring tube a chance of draining.

Solutions for Gas Analysis.

The absorption reagents used in ordinary gas analysis should be carefully prepared, as the velocities of the reactions vary, of course, as the strength of the solutions, and proper care ensures efficiency.

For sulphuretted hydrogen, 10 per cent. cadmium chloride is used.
For carbon dioxide, 20 per cent. caustic potash or caustic soda.
For unsaturated hydrocarbons, a saturated solution of bromine water.
For oxygen, a solution of pyrogallol in 20 per cent. NaOH in which the soda is in strong excess.
For carbon monoxide, saturated acid solution of cuprous chloride.

The pyrogallol must be strongly alkaline; otherwise you will find that it gives off CO. Ammoniacal cuprous chloride is more rapid than the acid solution; but it is more troublesome in the pipette, and leaves the gas saturated with ammonia, which has to be removed by an additional absorption pipette of dilute acid. In addition to this, it saturates the water in the burette, and makes it alkaline.

In performing the analysis, the burette should be filled with water saturated with the gas under test, and which is also made distinctly acid. It is best to keep a litmus paper in the levelling-bottle, so that the acidity of the water can be under observation. The funnel should be filled with dilute hydrochloric acid. The burette is filled with gas by connecting the source of supply to the capillary tube, and lowering the levelling-bottle until more than 100 c.c. of gas has entered the burette. The cock is then closed, and the apparatus disconnected from the source of supply. The gas is compressed in the burette by raising the levelling-bottle, until the water reaches zero. The tube is clipped, and the cock momentarily opened to the atmosphere and closed. The burette is then levelled off, and it will be found that there are just 100 c.c. in it. The capillary is filled with dilute acid from the funnel; and the apparatus is now ready to proceed with the analysis.

Method of Procedure.

The analysis is conducted in the ordinary manner. I do not intend to weary you with a detailed description of the manipulation; but I should like to draw attention to one or two matters that should be carefully watched. For sulphuretted hydrogen, a 10 per cent. solution of cadmium chloride is usually employed as the absorbent. This solution, while absorbing all the H_2S, will, if left in contact with the gas, slowly absorb CO_2 as well, so that it is not possible to go on shaking for an indefinite period. In fact, the method I have adopted for absorption with cadmium chloride is to allow the gas to pass into the pipette and remain for one minute, timed, without shaking. The absorption is then complete. For unsaturated hydrocarbons, when using bromine water, a long contact is necessary, and at least five minutes should be given to the absorption, and the pipette should be well shaken. Pyrogallol is somewhat slow in action, and a good time should be given for this absorption—about five minutes. Carbon monoxide is not completely removed by cuprous chloride in one absorption, no matter how fresh the solutions are. At least two absorptions are necessary, using different pipettes. The solution appears to get fatigued, and is incapable of removing the last traces.

In working with apparatus in which water is used as the confining medium, great care has to be taken that proper periods are allowed between each absorption and measurement, to allow the

burette to drain. It does not matter if the burette is allowed to drain completely; but the period must be of exactly the same duration in each case. Carelessness in this respect will render any analysis useless.

If care is exercised in carrying out analyses on the lines I have indicated, they should be strictly comparable, and, in fact, may easily compare well with analyses made over mercury. Hempel's apparatus enables the operator to make complete analyses; but the disadvantage of his method and apparatus is lack of portability and the fact that it does not give very open readings.

We have designed a modification of the Davidson burette, so that complete analyses may be made with rapidity and ease. My intention in arranging this apparatus was not so that it could be used for exact analysis, but for making complete analysis for the evaluation of producer gases, such as Mond gas, &c. It can, of course, also be used for complete analyses of coal gas. It is arranged for portability, and is a complete unit.

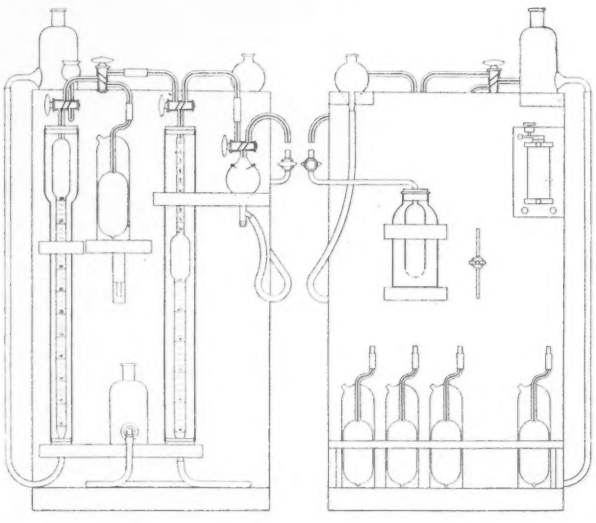


Fig. 2.

Fig. 3.

Figs. 2 and 3 illustrate the apparatus very fully; and there is no necessity for me to trouble you with its detail. An aliquot portion of the residue after absorption of CO is measured in the second burette. A sufficient quantity of air is allowed to enter; and a volume of hydrogen equal to the volume of gaseous residue used is added. The total mixture is measured and passed into the explosion head, where it is exploded. The contraction is measured in the mixing burette. A small quantity of 20 per cent. soda is allowed to enter the explosion pipette; and the CO_2 resulting from the combustion is absorbed by passing the gases back into the bulb. The absorption of CO_2 is measured in the mixing burette. In case any mishap occurs in the explosion, the bulk of the residual gases is retained in the measuring burette.

Estimation of Nitrogen.

In the usual way, when recording analyses of gases, nitrogen is estimated by difference. This means that the errors in estimating the constituent gases are all totalled and included in the nitrogen figure, which is therefore most likely to be in error. Methods have lately been adopted for directly estimating nitrogen by combustion over red-hot copper oxide. Many of the types of apparatus for the purpose are very complicated and awkward to use; but I have here an apparatus originally designed by Dr. Davidson, which is easy of manipulation and very rapid—see fig. 4.

The measuring burette consists of a very narrow tube and a bulb which together contain 25 c.c. The narrow tube is graduated in 5 c.c. in 1-10ths. Below the measuring bulb is another and larger bulb. The copper oxide is contained in a quartz tube communicating with a large bulb fitted with a two-way cock. The apparatus is filled with mercury. The method of procedure is as follows: 25 c.c. of gas is measured in the burette. The copper oxide tube, which is bright red-hot, is evacuated by lowering the mercury in the large bulb once or twice. This bulb is sufficiently large to carry this out usually "in once." The gas is now allowed to slowly enter the copper oxide tube, and is slowly passed backwards and forwards over the hot copper oxide. The gases are then drawn into the large bulb, and the tube evacuated. A little 20 per cent. NaOH is put in, and the CO_2 is absorbed. The residual nitrogen is drawn over into the measuring burette. The oxide tube is again evacuated, and the nitrogen measured. The operation occupies about twenty minutes, and is very complete and accurate.

The value of such a method as this is very apparent, as the estimation of nitrogen is most important to the gas maker. A proper knowledge of the nitrogen content of his gas enables him to more easily trace and remedy faults in working, and also assists him in keeping a very careful watch on plant. It is especially useful in cases where new work is being put on, and there are no means of separating the gas. The method is extremely simple, and can be worked by anybody of ordinary intelligence after a few minutes' explanation and a little practice. One must take the precaution of revivifying the oxide tube after each estimation; otherwise it will rapidly become unfit for use.

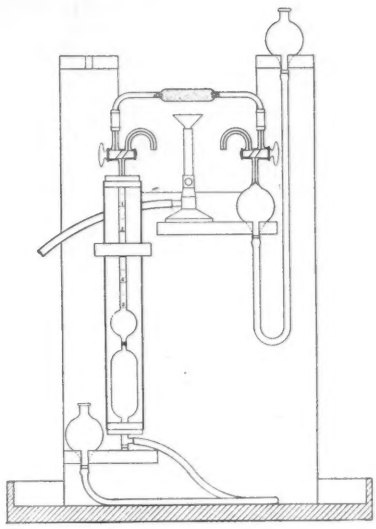


Fig. 4.

Exact Gas Analysis.

I wish now to call your attention to methods in use for making exact analyses of gas, such as coal gas. These analyses have to be made using mercury as a confining medium, and most of the apparatus in use is very bulky and cumbersome. It is also necessary to employ reagents which are very rapid, to prevent too long contact with them. The amount of reagent used must be very small; so that the gases will not be dissolved by them to any measurable extent. Precautions have to be taken to correct for the influence of changes in barometric pressure during the analysis; and for technical purposes the apparatus must be rapid. The various designs may be classed under two heads—(*a*) constant pressure apparatus, and (*b*) constant volume apparatus.

The apparatus under heading (*b*) is the more useful from our point of view, and is probably more accurate in working. The absorptions are measured by the alterations in partial pressure of the gas under vacuum, and are read by means of a manometer tube. The apparatus most in use is that designed by Bone and Wheeler. For certain reasons, it was found necessary to somewhat modify this apparatus; and I propose to describe to you the apparatus we have in use at the Central Laboratory—see fig. 5.

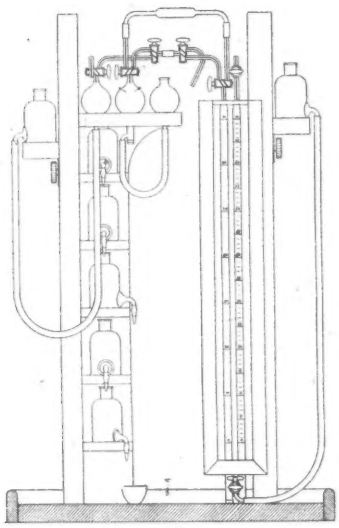


Fig. 5.

It consists of two graduated tubes immersed in a water-jacket; these tubes being in communication with each other and with a levelling-bottle. Both tubes have graduations upon them; one being graduated in millimetres, and having a single cock at the top used as a manometer. The other is graduated every 10 cm. or so, and contains the gas under analysis. They are about 740 mm. long. The containing tube communicates with an explosion pipette and an absorption pipette, both of which are fitted with two-way cocks. The apparatus may be fitted with a quartz tube for the direct estimation of nitrogen. A small volume of the gas under examination is placed in the containing burette and expanded to the zero mark, and the height of the manometer

read. The absorptions are made in the special absorption pipette, using small quantities of fresh solutions for each estimation. The pipette, &c., must after each absorption be carefully washed out with dilute sulphuric acid. The gas is expanded to the same mark each time, and the difference in the height of the mercury in the manometer is equivalent to the volume of gas absorbed. The residual gas, after estimation of the CO, is mixed with pure oxygen and air, and exploded in the special pipette.

This is where the difficulty of the operation comes in. If the gases under test are similar in composition, there is no difficulty about the explosion, as one can readily get an idea of the proper mixture for explosion. But if the gases are of strange composition, it is easy to get erroneous results by reason of improper combustion; and here it will be seen that the method of estimating nitrogen by difference can easily be wrong, as all the analyses add up to 100. For this reason, we make an estimation of nitrogen direct for each analysis we carry out. If the figure obtained by difference is not confirmed, the analysis is done again. Here, again, the value of the direct estimation of nitrogen is apparent. It is absolutely essential for purposes of gas analyses that some such check be made each time.

I might mention here the direct estimation of hydrogen by an absorption solution consisting of colloidal palladium in sodium picrate. This is a very good method, but is very slow; the absorption taking from twenty minutes to half-an-hour. The solution is also very expensive.

I cannot lay too much stress upon the necessity for every precaution and care in making complete analysis, if the results are to be of any use—and they most certainly can be of great use. It has often been said that calorific value calculated from gas analyses cannot be relied upon. I have examples of some 200 analyses of coal gas in which the calculated calorific value agrees with the actual within 1 per cent.; many of them being closer. Therefore, as this is the case, it is easily seen how valuable complete analyses can be. At the same time, it is absolutely essential, to properly interpret results, to have a thorough knowledge of your samples, and to have proper samples.

When calculating calorific value from the complete gas analysis, it must be remembered that the composition of the unsaturated hydrocarbons is not certain. They are usually regarded as being a mixture of benzene and ethylene; but for the purpose of this calculation it will not be far in error to regard them as propylene. The figures given in Lunge's "Technical Methods" for the calorific values of constituent gases are as follows :—

Gas.	Calorific Value in B.Th.U. per Cubic Foot at 60° Fahr. 30″ Bar. Moist.		
	Gross.		Net.
Hydrogen	321	..	275
Carbon monoxide	321	..	..
Sulphuretted hydrogen	646	..	602
Methane	1003	..	911
Ethylene	1578	..	1486
Propylene	2319	..	2182
Benzene vapour	3708	..	3570

You will notice that the calorific value of a mixture of 2 parts of ethylene and 1 part of benzene corresponds to propylene. Using these figures for coal gas, the calculated calorific value corresponds very closely indeed to the actual, as will be seen in the following table:

Gas Analysis.							Actual Calorific Value. Net.	Calculated Calorific Value. Net.
CO_2.	H.C.	O_2.	CO.	CH_4.	H_2.	N_2.		
3·1	4·1	0·4	9·2	31·7	39·0	12·5	514	515
2·5	3·7	0·7	9·9	28·7	44·8	9·7	496	497
2·8	3·7	0 5	9·3	33·2	44 1	6·4	531	534
2·8	3·1	0·7	7·1	31·4	46·4	8·5	504	504
3·7	3·5	0·2	6·3	27·5	33·8	25·0	441	440

I have purposely chosen a few examples showing gases of various compositions.

It is not possible to calculate the calorific value of the carburetted water gas with any degree of certainty, as it contains a very high percentage of unsaturated hydrocarbons—that is, of course, unless one takes the great trouble to investigate carefully the composition of these hydrocarbons.

Typical Analyses.

I have pleasure in presenting a few typical examples of gas analyses. These, with two exceptions, have all been made upon the complete mercury apparatus described above, and I hope they may be of some small value to the members.

Coal Gas.

Gas from—	Analysis (per Cent.).							Calorific Value
	CO_2.	HC.	O_2.	CO.	CH_4.	H_2.	N_2.	
A	2·19	3 38	0·54	9·68	31·5	47·3	5·4	525
B.	2·25	3·78	0·52	9·85	26·8	49·2	7·6	494
C	2·20	2·73	0·44	10·65	27·0	51·0	6·0	480
D	2·57	2·80	0·36	13·87	25·4	49·8	5·2	472
E	2 40	3·02	0·48	10·90	30·8	45·5	6·9	507

[A. Horizontal retorts, six-hour charges. B. Do., heavy charges. C. Dessau retorts, twelve-hour charges. D. Do., do., with steam. E. Woodall-Duckham.]

Water Gas.

Gas.	Analysis (per Cent.).						
	CO_2.	HC.	O_2.	CO.	CH_4.	H_2.	N_2.
Humphreys and Glasgow, blue water gas—							
1st minute of run	6·8	*Nil*	0 2	38·3	2·5	49·7	2·5
2nd ,, ,, ,,	4·2	,,	*Nil*	42·0	2·5	47·4	3·8
3rd ,, ,, ,,	1·8	,,	,,	47·0	1·5	47·5	2·0
4th ,, ,, ,,	4·6	,,	,,	43·2	0·8	48·5	2·9
5th ,, ,, ,,	9 0	,,	,,	37·5	0·0	49 8	3·7
Dessau plant, blue water gas	4·8	,,	0·3	37·9	3·0	49·2	4·8
Carburetted water gas	4·1	12·5	0·2	30 7	20·0	28·4	4·1

Producer Gases.

Gas.	Analysis (per Cent).						
	CO_2	HC	O_2	CO	CH_4	H_2	N_2
Mond gas—							
Recovery (coal)	16·5	Trace	0·0	11·0	3·0	27 5	42·0
Non-recovery (coal)	9·9	0·3	0·3	20·0	2·8	17·8	48·9
Mixture of coal and coke dust.	13·0	0·3	0·4	14·6	2·0	15·4	54·3
Kerpeley producer	2·7	0·0	0·1	28·3	Trace	8·1	60·8
Ordinary inside producer	1·0	Trace	0·0	28·5	0·5	4·0	66·0

DISCUSSION.

The President (Mr. F. Shewring, of Droitwich) remarked that the paper contained very much matter, and great value had been added to it by the display of specimens of the different apparatus referred to, and by the explanations the author had given them outside the text of the paper. The value of technical analysis on gas-works was, he thought, admitted by most people connected with the profession; but it was a regrettable fact that so many works in Great Britain did without it. There might perhaps be several reasons for this; but it was a matter with which the Association could hardly concern themselves. The simplicity of the apparatus described, and of the manipulation of it, were features which it seemed to him would help to make testing on gas-works much more general than it was at the present moment, because in many cases where the testing had to be done by the manager himself, there were such a number of things making demands upon his attention—in the commercial section of the business more particularly—that he really could not give the amount of time that he would like to testing, and many things he would be only too glad to take up had to be put aside. The apparatus they had in front of them was very ingenious. He had himself had some experience in gas testing with the Orsat apparatus—more particularly with furnace gases—and he quite agreed with the author that it was difficult at times to get intimate contact of the gases with the solution. In view of this, he bought an apparatus brought out some few years ago by Mr. Dickenson-Gair, who had an arrangement of rubber connections, so that the pipettes could be taken off and shaken. But he must say that Dr. Davidson's apparatus was, in his opinion, simpler; and it should have a very wide field on gas-works in preference to the Orsat and some other apparatus which was on the market. The table at the end of the paper giving particulars of analyses of coal gas would be a useful addition to their literature, and would be helpful at times for comparison with results obtained by themselves. In fact, they were indebted to the author for submitting the whole collection of tables. They were pleased to have had such a good paper, and he had great pleasure in proposing a hearty vote of thanks to Mr. Balcon for it.

Dr. W. B. Davidson (Birmingham) said that the matter before them was one in which he took a keen interest, and he would therefore like to make a few remarks on the paper. He thought Mr. Balcon had chosen a subject of great utility to the gas profession, but he wished he could have entered into greater detail with regard to the manipulation of the apparatus. He (Dr. Davidson) had noticed in class work how utterly incapable a beginner was in the manipulation of the apparatus for gas analysis. He had to have perhaps a dozen tries before he got the simplest gas analysis completed. There was, it seemed to him, hardly any other measurement that had so many pitfalls as gas analysis. It compared in this respect with candle-power estimation. He thought Mr. Balcon had not avoided all the pitfalls in trying to cover this field, and perhaps he would excuse him if he pointed out one or two. The author mentioned Hempel's apparatus as being almost universally used, but on the Continent it was Bunte's that was the favourite. There, in the best laboratories, they used a room in which the temperature did not vary, and it was not necessary to jacket the apparatus. The Bunte apparatus was a very simple one; and with care it gave good results. In connection with the question of accuracy in reading, he might say that he preferred to use a special apparatus for special work, rather than do all his analyses with one apparatus. It was not possible to get the highest degree of accuracy with gases which only amounted to about ½ per cent. in volume, like oxygen, in the same apparatus as they did with hydrogen, which had a large percentage. This was the reason why the apparatus

referred to in the paper was designed with a long scale for accurate reading in cubic centimetres. He did not agree that it was necessary to have a pipette which could be shaken. They all knew that there were good gas scrubbers which were not in motion, and they could surely scrub the gas in a number of tubes in the Orsat pipette just as well as they could in a pipette with a wide diameter.

Mr. BALCON: It would save time.

Dr. DAVIDSON replied that he did not think so, but it was a matter of opinion. Then with regard to the estimation of sulphuretted hydrogen, he did not know of any other gas-works in the country where they estimated sulphuretted hydrogen by the cadmium chloride method. There might, of course, be some, but it was not usual. It was introduced by Dr. Colman a great many years ago in Birmingham, and had been retained. It was not, however, a really accurate method, and Mr. Balcon's modification of allowing the gas to remain for one minute, without shaking, in the pipette was to his mind a very serious fault. He had actually tried it that day, and he found that one got less than half the sulphuretted hydrogen in many cases. To show how far the old method was correct, he took out the sulphur for the Nechells works in the last three years ending September, and worked back to the percentage of sulphuretted hydrogen in the crude gas. It came to 1·38, and the actual gas analysis, using the two or three minutes, came out, he believed, at 1·3. At any rate, the error was in the second decimal place, showing that the method was fairly accurate. At one time, they used to collect samples for analysis overnight; but they had to give this up, because the sulphuretted hydrogen was so low, due to oxidation. It was necessary to have a fresh sample. He thought it was a very serious matter to put forward without proof a fresh method, which was, he was sure, very faulty. If they read the books on gas analysis by Hempel and others, they found that for their methods the authors gave proofs. They had taken certain percentages of the different gases, had actually put them together, and had analyzed them, and given the figures. Mr. Balcon gave no proofs, but wanted the members to accept all his figures. He (the speaker) did not think that they should be accepted in this way. The carbon monoxide he had found, if it was desired to be quite accurate, required to be absorbed four times in four different solutions. They got generally 90 per cent. in the first solution. Then the second solution would give them 90 per cent. of that solution left, which was 9 per cent. Thus they were not quite correct even in the second solution, and this affected the CH_4 in the final analysis. Of course, he did not recommend going beyond two absorptions, as he thought if they got to within the limit he had mentioned it was quite good enough. The apparatus described by Mr. Balcon, and illustrated in figs. 2 and 3 in the paper, seemed to him to be an ingenious and good modification. He should think it would be very useful; but he could not quite see how the error of the capillary was got over between the second burette and the mercury. He thought this capillary tube might be a source of error, but perhaps he was wrong. It did seem to him, when he first read about it, that there would be the usual objection about the CO_2. The reason why they could not use water in exploding the gas was due to the fact that, under high pressure, CO_2 was taken up readily by the water; but he thought in this case the trouble was got over, because it was exploded over mercury. He did not think, in the nitrogen apparatus, that it was to be recommended to evacuate the copper oxide tube "in once," because, after all, the bulb was really only a pump, and the first stroke would not evacuate the gas. A second stroke would bring it down to a minimum which would be negligible. The reason, in exact gas analysis, why it was necessary to employ reagents which were very rapid, or made up in the most careful way, was not so much to prevent too long contact as to avoid a too large quantity of solution. This was a point always present in analyzing gas over water. Professor Bone, when he submitted his paper on "Gas Analysis," objected entirely to all apparatus in which water was the enclosing medium; but he (the speaker) was of opinion that they had proved they did get fairly accurate results by using water. When using the words "two-way cocks" in his paper, did not Mr. Balcon mean three-way cocks? This, at any rate, was the general term in the glass trade. A three-way cock was one with three branches; an ordinary stopcock was a two-way cock. He quite agreed with the author as to the necessity of checking the nitrogen figure—that was, determining the nitrogen directly; but he totally disagreed with the statement that calorific values calculated from gas analyses agreed with the actual within 1 per cent. He had had many instances of a disagreement of 3 per cent., or even more. There seemed to be some errors in the table in the paper which dealt with this matter. The gross calorific value in B.Th.U. per cubic foot of hydrogen was given as 321, whereas it should be 311, according to his own note-book. The net values given, too, were not the real net values, which were 268 for hydrogen, 321 for carbon monoxide, 897 for methane, and 2160 for propylene. These were the real net values which one got in a calorimeter—deducting the latent heat, *plus* the calories lost when the water cooled from 100° C. to ordinary temperature. These were the figures generally accepted, and the figures given by Dr. Colman when reading Mr. Klumpp's paper on "Calorimetry" in 1910 before the Institution of Gas Engineers. In this paper, which was a very thorough and a very valuable one, the opinion was expressed that calculating calorific value from gas analysis, as far as it referred to illuminating gases such as coal gas or carburetted water gas, was of no value in regulating the manufacture, or even for arriving at the approximate real calorific value. Such calculations could only be used as checks. As to the next table, he had re-calculated the calorific value figures of Mr. Balcon which showed such remarkable concordance with the actual calorific value; and, taking the first line, he got, instead of 515, a figure of 507—a difference of 1·4 per cent. Instead of 497, he got 489 (difference, 1·4 per cent.); instead of 534, 526 (difference, 0·9 per cent.); instead of 504, 496 (difference, 1·8 per cent.); and instead of 440, 433 (difference, 1·8 per cent.). Thus in two instances there was a difference of 1·8 per cent. Then he had taken out 36 analyses of Nechells coal gas during the last few months, and found seventeen were over 2 per cent. out, and seven were over 3 per cent. out—taking the real net value—and some were up and some were down. This, he thought, proved that they could not rely upon gas analysis for the calorific value; and it would be very absurd, of course, to do so, because they could determine the calorific value in 6 or 10 minutes without calculation, whereas it would take them a good hour-and-a-half or more with gas analysis, and they would be far more certain with a larger sample of gas than with gas analysis. As had been pointed out, the errors tended to be cumulative; and even if they did a check nitrogen, they did not know what errors they had in other respects, and most of all in the hydrocarbons. In regard to the unsaturated hydrocarbons, the author said he took 2 parts of ethylene and 1 part of benzene. What were the grounds for doing this? No doubt with certain gases, in which the hydrocarbons did not amount to more than 2½ per cent., one could approach the actual calorific power with gas analysis; but it would be very foolish for any one to depend upon an analysis of gas to show what the calorific value was. He did not at all agree with the figures given for water gas, showing the analysis during different minutes of the run. He would like to ask Mr. Balcon if he had checked them, or how he explained the difference in CO_2, which was 6·8 for the first minute, and 9 for the last, and only 1·8 in the middle. As to the analyses marked A to E, had they all been carried out with the same coal and under the same conditions, and were the analyses put forward as representative? That was to say, for example, by steaming did they increase the hydrocarbons in the Dessau retorts, as shown in the paper, and so on? If the figures were simply haphazard, taken at random, what was the use of them? He was sorry to put forward all these criticisms; but Mr. Balcon was a man who took hard knocks, and certainly he was one who could give them.

Mr. E. H. WRIGHT (Wolverhampton) said the author mentioned, in the case of the Orsat apparatus, the liability of the gas to pass down a central tube and bubble out through the solution. He had had experience with the Orsat apparatus, and had never found this trouble. It was mentioned by the author that a litmus paper was kept in the levelling-bottle. Would there be anything detrimental in using a little methyl orange in the water? It was much more easy to gauge the level. Dr. Davidson had touched on the estimation of sulphuretted hydrogen by cadmium chloride, He might say that at Wolverhampton they used cadmium chloride and they generally got about 1·5 per cent. by volume. As to the table to which Dr. Davidson had last referred, he would like to ask the author whether he had checked the figures with regard to the analysis of water gas. They seemed to him to be very confusing.

The HON. SECRETARY (Mr. W. J. Pickering, Birmingham), in seconding the vote of thanks, said they were much indebted to Mr. Balcon for bringing forward the information to which they had listened that afternoon. Though the paper covered ground which was very familiar to many of them, it would be useful to have in the "Transactions," as hitherto the matter had not been dealt with at their meetings. He would like to endorse, first of all, the great advantages of the apparatus specially designed by Dr. Davidson, which had been employed in Birmingham in place of the Hempel apparatus. He (the speaker) had the pleasure of working this apparatus, he believed, first in their department; and he could bear out all that had been said in the paper as to the many advantages in connection with it. It was a very necessary thing to impress upon the beginner the importance of small points—such as the taking of the sample in a proper manner, and allowing the same time for draining between each absorption. Constant errors would creep in unless little points were watched; and, as Dr. Davidson had said, the beginner was apt to overlook them. He rather wished Mr. Balcon had more elaborated the utility of gas analysis figures in gas manufacture. He (Mr. Pickering) thought gas analysis, properly carried out, was certainly of great value to the industry; and even if they could not calculate calorific value from it to within less than 3 per cent., this was surely useful on occasions. If they had a plant working, and the gas joining a stream of gas from another plant, and they wanted some indication of the calorific value, but could not isolate the particular gas stream, it would be useful to be able to calculate the calorific value by means of the gas analysis.

Mr. BALCON, after thanking the members for the manner in which they had received his paper, said he would like first of all to answer a few of the questions Dr. Davidson had put. The points brought forward by Dr. Davidson were, of course, worthy of every consideration; and he was only sorry that he had laid himself open to so much criticism. When reading the paper, he mentioned that, though he had adopted for calculation 2 parts of ethylene and 1 part of benzene, the analysis of the unsaturated hydrocarbons generally gave 0·8 to 0·9 per cent. of benzene. The figures given for the calorific value of the constituents of coal gas

were taken from Lunge's "Technical Methods." The portion dealing with gas analysis was, he believed, written by Dr. Otto Pfeiffer, and revised and translated partially by Dr. Colman; and he had taken this authority for the figures. He had not given them as his own.

Dr. DAVIDSON: Are there not two sets of figures?

Mr. BALCON: These are the only figures.

Dr. DAVIDSON: Dr. Colman gave two sets, called "Net A." and "Net B." These figures are not the ones you would use for a calorimeter.

Mr. BALCON said he remembered the figures Dr. Colman had given. The reason he had given the calculated results included in his paper was because, using these figures, they calculated out so accurately with the actual calorific values. He did not want them to understand that he said gas analysis gave them calorific value; but what he wanted to point out was that it was possible that complete gas analysis could be of use to them where it was not practicable to have a calorimeter. For instance, he knew of a new plant starting-up which was in connection with other gas-works plant; and it was found necessary to get some idea of the quality of the gas made by this plant. Surely, the method of taking a sample and making a complete analysis, and calculating a calorific value from this which might give them within 1·8 to 2 per cent., was extremely useful in circumstances like this. He apologized for calling two-way cocks what ought to be termed three-way cocks. In regard to the capillarity error in the second connection, he had puzzled over this for some time; but it had proved quite easy to get over. The method with which Dr. Davidson sought to saddle him for the estimation of sulphuretted hydrogen, he could not claim credit for, as it was Otto Pfeiffer's. In the book he had already referred to, it said that contact with the solution for one minute was sufficient for complete elimination of sulphuretted hydrogen, and that shaking was unnecessary and inadvisable. He himself did have a shot at this matter the previous day, and shook vigorously for a short time, with very little result. There was a slight increase, but not sufficient to warrant any alteration. He made a large number of tests a long time ago, as to the advisability of substituting another reagent for cadmium chloride, but they stuck to it because it was easy to use. It was necessary when employing it to put a time limit to its working. When he said that the Hempel apparatus was almost universally used, he meant it was probably more in use in this country and in America than any other. On the Continent, also, he believed it was very largely employed. Bunte's burette, though very simple, was only workable in the hands of a really skilled chemist; whereas the apparatus they had before them that afternoon could be used by youths, and probably by intelligent workmen. Bunte's apparatus would be a source of considerable error in the hands of a workman. He had not included in his paper any details of manipulation, because he did not think the members wanted them. Mr. Wright mentioned that he had an Orsat apparatus in which the gas did not bubble through. Well, he congratulated him. He (the speaker) had three or four, and they all acted in this way. Methyl orange in the levelling-bottle would be an excellent substitute for litmus paper. It was a very good idea. As to the figures in the tables giving examples of gas analyses, these were submitted as typical from the point of view of what could be done with gas analysis apparatus. He did not want them to go down to posterity as embodying his ideas of what gas analysis should be; but he thought the figures for "A," "B," "C," "D," and "E" in the coal-gas table were taken with the same coal for comparative purposes. The "C" and "D" figures were given as Dessau retort working with steaming and without. He believed if they calculated back on a similar percentage of nitrogen, the hydrocarbon figures showed in the right direction. The nitrogen was something that should not be there, and to really compare analyses properly, they should be calculated on a proper percentage of nitrogen.

Dr. DAVIDSON: There is only a difference of 1 per cent. in the nitrogen.

Mr. BALCON (continuing) said that, because the tests happened to be with the same coals, he did not want it to be taken that steaming increased the hydrocarbons contained in the gas; for it was the other way about. The analyses given were not standard figures, but they showed how it was possible to trace their processes and watch methods. The point that he wanted to bring home was that it was possible to investigate and control their manufacturing operations by means of a certain amount of scientific knowledge.

Masonic.—What is now looked upon as an annual function in connection with the Evening Star Lodge was the "Ladies' Night" last Wednesday at the Connaught Rooms, Great Queen Street. About 230 members of the Lodge, with their friends, both ladies and gentlemen, attended the reception held by the W.M., Bro. C. W. Offord (of Enfield) and his wife, and subsequently dined together. A musical entertainment followed.

Position of Coal Gas in the United States.—An esteemed correspondent in New York, who occupies a prominent position in connection with the gas industry, in the course of a business letter just to hand, mentions that there is now a great tendency towards coal gas, owing to the rising price of oil; and he says he would not be at all surprised if he lived to see gas, with modern machinery, in the ascendency for the supply of the large cities in the United States.

HYGIENE AND THE WARMING PROBLEM.

These are the days of rapid movement, and days when a considerable section of the public like information conveyed to them in condensed form. Hygiene and the warming problem supply subject-matter covering an immense area; but in a pamphlet, a copy of which we have before us, Messrs. John Wright and Co. have managed to squeeze into the first ten pages the salient features concerning domestic heating by the modern gas-fire. There we have stated with brevity, and in pellucid manner, the case for the means of heating which puts refinement in place of the old crude method, and the combined virtues of which form of heating stand foremost among the competitors. The reasons for this are presented, and in a way that the layman in these matters who reads will understand. There was a paragraph in the front part of our issue last week on "The Retreat of the Coal Fire;" and that paragraph contained information that confirms the very opening lines of the pamphlet under notice. "There are signs abroad," says the writer, "that even the man in the street can read, pointing to the fact that the long ascendancy of the time-honoured coal fire is at last on the wane." With the evolution of things in these days, there is combined a continuous restlessness throughout the community to escape more and more from the laborious ways of our forefathers; and, in this matter of domestic heating, the gas-fire is at hand—the modern form not only asking of the user no labour or any provision of fuel, but, as the pamphlet shows, it gives him radiant heat (which is Nature's mode of heating), with a moderate proportion of low temperature convected heat. Science has eliminated the discomforts of the old form of gas-fire, and simultaneously has imparted rich effects in the matter of heating with an unassailable hygienic efficiency in the fires that are scientifically designed. The method of heatiug is a healthy one for indoors; and, at the same time, it does not contribute to the contamination of the outer atmosphere as does the coal fire, with all its noxious effects. The case is prepared in the pamphlet in a convincing manner, and that it is written in readable form for the layman may be seen by just one extract dealing with the question of economy:

> One question remains which, though not one of hygiene, cannot be overlooked—that of economy. If the new type of gas-fire were not equal to the coal fire in that all-important respect, the value of its hygienic perfections would be substantially discounted. Its economy, however, stands beyond all doubt. The fact that on test it is found to give out about 75 per cent. of the B.Th.U. in the gas into the apartment, means much in this regard—for the remaining 20 to 25 per cent. utilized for flue draught and ventilation is a necessary provision. This economy is effected by various means—among them the fact that while the old-type fire was narrow and deep, so passing much of its heat unused up the flue, this new type is only the depth of one thickness of radiants, and is made correspondingly broader so as to equal in heating area the coal fire it replaces. This "wide-fire" principle is one of the most valuable innovations embodied in the new type, and so is the absence of front firebars, with their obstruction to the heat rays. Added to this feature of economy is the obvious saving arising from the fact that a gas-fire need not be lit till the moment it is wanted, nor kept alight a moment after the need is at an end; while there is also the economy of labour through the absence of need for coal-carrying, fire kindling and tending, grate cleaning and dusting. Altogether the case for economy in the latest type of gas-fire is as convincing as that for its hygienic perfection.

BYE-PRODUCT RECOVERY AT COKE-OVENS.

The special lecturer at a meeting of the Manchester Section of the Society of Chemical Industry held at the Grand Hotel in that city last Friday evening, was Mr. J. E. CHRISTOPHER, who had for his subject "Progress in Bye-Product Recovery at Coke-Ovens." Dr. GILBERT J. FOWLER occupied the chair.

Mr. CHRISTOPHER, in the course of his remarks, said that in 1900 the world's output of sulphate of ammonia was less than half-a-million tons; but the price had been well maintained. In this country the use of sulphate of ammonia had not made headway as compared with the Continent. There was plenty of work for the Sulphate of Ammonia Committee, when it was considered that, out of our production of 369,000 tons, only 70,000 tons were used in this country, while practically the whole of the German production was utilized on German soil. An average wheat crop removed 48 lbs. of nitrogen from an acre of soil; so that in this country more than half the total output was extracted from the soil by wheat alone. The outlets for tar also appeared promising, with the increased demand for hard-surfaced and dustless roads. The main outlet for benzol must lie in the direction of motor spirit. In 1905, the import of petroleum spirit into the United Kingdom was 19,459,000 gallons; in 1906, it was 26,335,000 gallons; and in 1907, 33,180,000 gallons. Assuming an average yield of one gallon of motor benzol per ton of coal, the coke-works of this country could turn out 19 million gallons annually; so that the field for the exploitation of benzol as motor spirit was extensive. The production of gas for purposes of illumination as a bye-product of the coke industry had lately made considerable headway. In the six years from 1903 to 1910, the quantity of gas produced in this way in Germany had

increased from 13¾ million cubic feet to 1472 millions; and a company had been formed to supply coke-oven gas to the Municipality of Ghent, at a price equivalent to 5·4d. per 1000 cubic feet. It was not suggested that gas manufactured in coke-ovens would ever displace the modern vertical retort, with its advantages of continuous carbonization; but an attempt had been made to show the value of coke-oven gas as a bye-product pure and simple.

In the discussion which followed,

Mr. JOHN BOND (Southport) asked whether the lecturer had any experience of inclined ovens, with regard to the cost of discharging the coke from these ovens as compared with the horizontal ovens which had been shown on the diagrams.

Mr. CHRISTOPHER said he had no figures on the subject. He knew of no installation in this country, though they were becoming fairly extensive on the Continent.

Mr. W. H. COLEMAN referred to the importance of the question of motor spirit, which had of late been brought before the public in a very acute form. In 1908, 68 million gallons of petrol had been imported into the United Kingdom; but this could not all be replaced by benzol recovered in the course of coke manufacture. If, however, the whole of the coke produced in the country was made in recovery ovens, he thought they might get about 29 million gallons.

The customary votes of thanks concluded the proceedings.

FRACTIONAL DISTILLATION OF COAL.

Results Obtained at Different Temperatures.

The number of the "Comptes Rendus" for the 23rd ult. contains a paper on this subject by M. Leo Vignon, which was submitted to the Paris Academy of Sciences by M. Carnot. It gives the results of a study of different samples of coal for the production of gas at various temperatures; and the following particulars have been extracted from it.

A measured quantity (100 grammes) of crushed coal was placed in an iron tube, and heated in an electric resistance furnace successively to 400°, 600°, 850°, 1000°, and 1200° C. Each of these temperatures was maintained until the gas had been almost completely driven off—starting at 350° C. and ending at 1200° C. The following figures show the percentage composition of the gas.

Montrambert Coal.

	400° C.	600° C.	850° C.	1000°–1150° C.	
CO	7·20	3·80	4·80	10·61	
H_2	0 00	1·70	69·15	74·19	
CH_4	64·96	81·09	17·63	8·20	
CO_2	8·80	4·40	1·40	3·00	
O	4·00	1·20	0·80	0·60	
N	11·02	3·14	3·21	2·40	
Hydrocarbons absorbable by bromine	4·00	4·60	3·00	1·00	
Volume of gas in litres	4·20	6·20	12·00	8·00	Total 30·4 litres
Duration of distillation	2 hours	1 h. 30 m.	45 m.	2 hours.	Total 6 h. 15 m.

Gas Coal.

	400° C.	600° C.	850° C.	1000°–1150° C.		
CO	2·60	7·70	11·40	9·50	19·40	
H_2	0·00	22·84	68·98	78·53	74·10	
CH_4	84·30	59·82	7·18	5·66	0·00	
CO_2	6·00	5 00	4·60	0·80	1·80	
O	2·40	1·00	1·30	0·20	1·00	
N	1·00	3·13	6·co	4·59	3·00	
Hydrocarbons absorbable by bromine	3·40	0·40	0·20	0·70	0·00	
Volume of gas in litres	5·00	10·00	5·50	7·10	5·00	Total 32·6 litres
Duration of distillation	3 hours	5 hours	3 h. 30 m.	1 h.	1 h.	Total 13 h. 30 m.

These results show that methane is almost entirely liberated before or at 600° C., while hydrogen distils particularly from 600° C. to 1150° C. The percentage of carbon monoxide increases with the temperature; the hydrocarbons absorbable by bromine (C_2H_2, C_2H_4, C_6H_6) distil at about 400° C. The separations are the more marked according to the duration of the distillation—13 h. 30 m. in the second case and 6 h. 15 m. in the first.

Three other samples of coal were treated in the same manner, with the following results.

Industrial Coal.

	400° C.	400°–600° C.	600°–800° C.	800°–1000° C.	1000°–1180° C.	
CO	1·70	3·00	8·20	8·50	30·20	
H_2	23·60	20·50	48·70	68·20	19·00	
CH_4	58·00	55·00	24·30	13·00	10·50	
CO_2	2·40	6·20	5·80	6·00	17·80	
O	2·00	3·20	2·60	1·00	1·50	
N	8·co	12·30	10·40	4·00	21·00	
Hydrocarbons absorbable by bromine	3·80	0·55	0·00	0·00	0·00	
Volume of gas in litres	1·66	7·90	7 20	10·60	5·30	Total 32·66 litres
Duration of distillation	2 hours	1 hour	1h. 40m.	1h. 30m.	1h. 30m.	Total 7 h. 40 m.

The following figures refer to Montrambert gas coal, containing 2·65 per cent. of water and 4·75 per cent. of ash; and Saarbruck coal, containing 2·85 per cent. of water and 9·25 per cent. of ash.

Montrambert Coal.

	0°–600° C.	600°–800° C.	800°–1000° C.	1000°–1200° C.	
CO	—	5·40	6·50	32·00	
H_2	2·70	36·00	59·80	37·50	
CH_4	76·00	45·00	24 30	13·60	
CO_2	6·00	10·80	5 20	14·90	
Air (O N)	10·co	2·00	4·00	2·00	
Hydrocarbons absorbable by bromine	5·00	1·00	—	—	
Volume of gas in litres	6 80	7·20	10·70	6·90	Total 31·6 litres
Duration of distillation	2 h. 45 m.	1 h. 10 m.	1 hr. 30 m.	45 m.	Total 6 h. 10 m.

Saarbruck Coal.

	0°–600° C.	600°–800° C.	800°–1000° C.	1000°–1200° C.	
CO	—	2·90	5·10	23·00	
H_2	2·40	24·50	62·00	45·00	
CH_4	80·50	59·50	12·00	10·80	
CO_2	3·20	2·40	2·40	10·00	
O	1·40	1·60	3·80	2·20	
N	5 60	6·40	15·20	8·80	
Hydrocarbons absorbable by bromine	6·80	2·60	—	—	
Volume of gas in litres	4·80	7·80	9·00	6·60	Total 28·2 litres
Duration of distillation	1 hour	1 hour	1 h. 20 m.	1 h. 25 m.	Total 4 h. 45 m.

The author says the following conclusions may be drawn from the preceding figures, which, notwithstanding some quantitative variations, are applicable to all the samples of coal dealt with:

(1) Imperfect hydrocarbons (C_2H_2, C_2H_4, C_6H_6) distil chiefly at a temperature below 600° C., and disappear at a high temperature.

(2) Methane and carbides are very abundant—60 to 84 per cent. up to 800° C.; and their proportion decreases rapidly with the temperature.

(3) Hydrogen, in small quantity (from 2 to 25 per cent.) up to 600° C., greatly predominates from 800° C. to 1000° C., and then sometimes decreases from this temperature up to 1200° C.

(4) Carbon monoxide, varying from 3 to 11 per cent., according to samples, with an average of 6·5 per cent. up to 850° C., may exceed 30 per cent. above 1000° C.

By increasing the temperatures of distillation, the total volume of gas collected augments; but the gas obtained at about 1000° C. has low calorific power, and generally contains a great deal of carbon monoxide.

PETROL-AIR GAS AND COAL GAS.

Some Useful Comparisons.

At the request of the Chairman of the British Commercial Gas Association, Mr. J. G. Clark, of the Gaslight and Coke Company, made some inquiries as to reliable data regarding petrol-air gas; and he obtained two reports—one by Mr. C. A. Smith, late of the East London College, and the other by a Committee of the Royal Scottish Society of Arts. The current "Bulletin" of the Association contains particulars of his investigations.

The following data were summarized from the reports; petrol being taken at 1s. 4d. per gallon, and the results worked out to the number of candle-hours obtainable for 1s.

Authority.	System.	Candle-Hours
Shearer, Royal Scottish Society of Arts	Inverted Incandescent.	5740
"Invetrol" System, Professor Smith's report	" "	5625
Professor Smith	" "	4175*
"	Upright Incandescent	3310

* Calculated as 25 per cent. better than the upright system.

These figures refer to the modern type of plant—viz., that producing a mixture of 98½ per cent. of air and 1½ per cent. of petrol vapour.

Mr. Clark recalculated the results of some German investigations; and the highest efficiency obtained—5675 candle-hours for 1s.—compared very well with the preceding figures. Taking the average (including those from the German tests), the result was 5304 candle-hours for 1s. Town gas worked out on the basis of 20 candles per cubic foot showed that, with petrol at the price named, petrol-air gas was equal to town gas at about 3s. 9d. per 1000 cubic feet. For heating and cooking purposes, Mr. Clark found the comparison quite simple, because the calorific value of petrol is well known, and may be taken at 140,000 B.Th.U. per gallon. Comparing this with gas at 520 B.Th.U. per cubic foot, he found that, with petrol at the price previously taken, a consumer would get 105,000 B.Th.U. at the cost of 1s., which would be equal to town gas at 5s. per 1000 cubic feet.

LONDON AND SOUTHERN JUNIOR ASSOCIATION.

Visit to the Bromley-by-Bow Gas-Works.

A DISTANT VIEW OF THE BROMLEY WORKS.

In spite of a heavy downpour of rain, which continued throughout the afternoon, many members of the London and Southern District Junior Gas Association turned up on Saturday at the Bromley-by-Bow works of the Gaslight and Coke Company. They were met at the entrance by the Works Engineer (Mr. R. Birkett) and his Assistant (Mr. W. Grogono); and the whole of the works and plant were inspected.

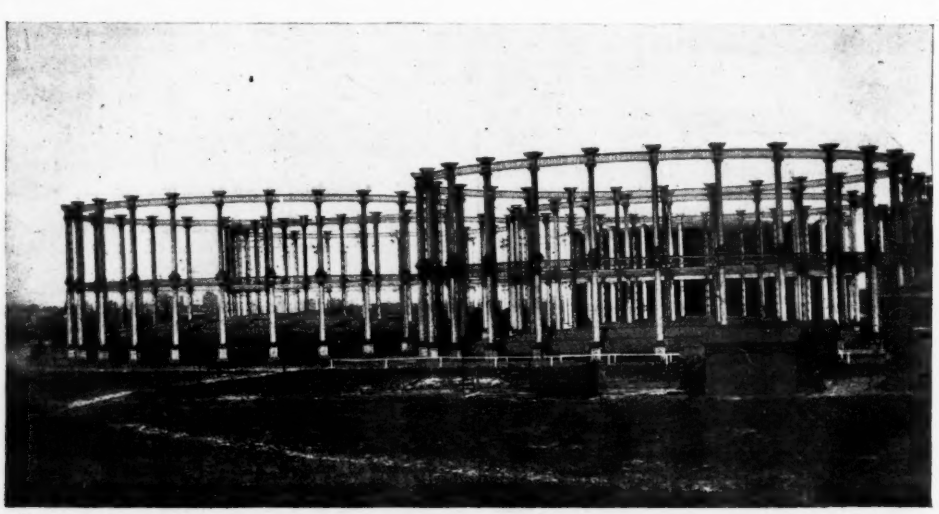
There are some striking features about this station, which is one of the largest works of the Gaslight and Coke Company; and perhaps the first point to impress the visitor is the large amount of land available for the works and for future extensions. The site comprises 175 acres, of which the works themselves, and the gasholders, occupy about 99 acres. The works were, it may be remarked, originally built by the Imperial Gas Company; and after passing the principal entrance gate, they are approached by a handsome two-span iron bridge over Bow Creek, the erection of which necessarily formed part of the scheme. The site is bounded on one side by the Great Eastern Railway, a siding from which now serves the works; but until quite recently there was entire dependence upon water carriage. As a matter of fact, at the present time all coal is sea-borne, and a certain amount of the coke is sent out the same way. The coal is in the first place unloaded at Beckton, and is then brought up the river in barges.

There is a magnificent dock, measuring about 100 feet by 1000 feet in convenient proximity to the retort-houses, which are in two lines, parallel lengthwise to it. As originally erected, the station contained four stage retort-houses—these being massively built, as are also other parts of the works—of a nominal aggregate productive capacity of 10 million cubic feet per day. At the edge of the dock, at two places opposite the middle of each pair of retort-houses, there are coal-lifts, each containing two grabs, for discharging the barges. By the grabs the coal is placed in trucks on an elevated railway, which is continued into and through the retort-houses, and from which either the retort-house coal-rooms are fed or the coal is tipped into outside stores on the far side of each retort-house.

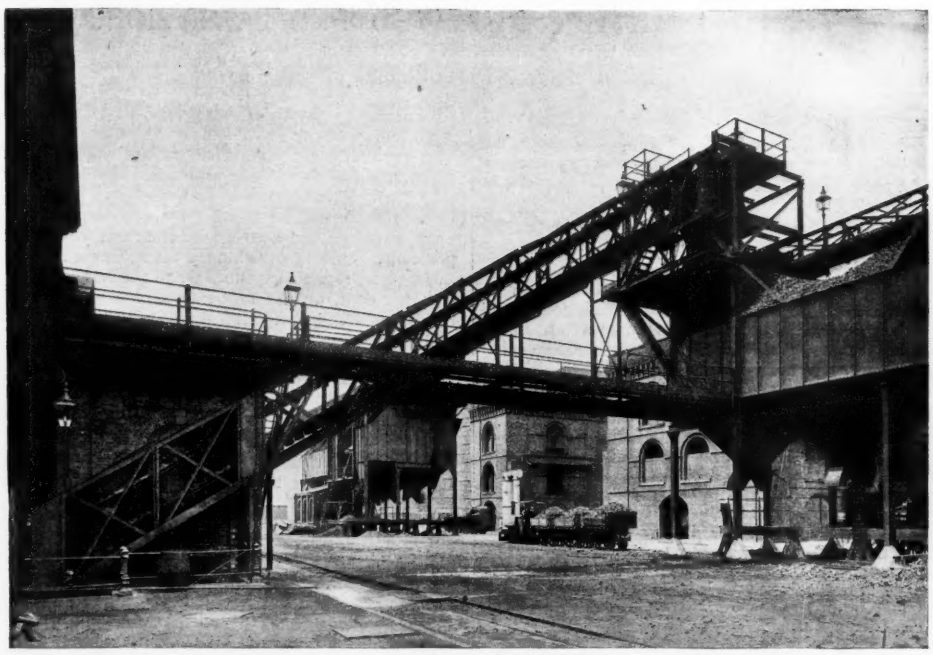
At present only two of the retort-houses are in use; and each contains twenty-six settings of ten retorts, 22 in. by 15 in. by 20 feet long. In each house there are two Arrol-Foulis charging machines; and in one (which has furnaces on both sides of the settings) there are two Hunter-Barnett coke-pushers. The other house, having furnaces on one side only, is provided with a single pusher of the same type. All the stoking machinery is operated by hydraulic power. The charges, which are fairly heavy, are of practically eight hours' duration. The coal is elevated from the coal-rooms by ordinary bucket elevators into hoppers over the charging machines. There are four of these elevators in each house—two on each side; so that the coal may be taken from one side or the other, as desired—and two of the large overhead hoppers. Four of the elevators are driven by gas, and the other four by steam; but the latter also are being converted to gas power.

The coke is removed from the retort-houses to the yard by Jenkins De Brouwer conveyors—in one house from one side only, of course, and in the other from both sides. It is quenched in its passage, and on reaching the yard is elevated and dropped into hoppers, where it is separated by screens into breeze and coke. There are also on the works two pan breeze washing and sorting plants, which deliver various sizes of clinker and coke separately, as well as mixed coke and clinker in the form of dust. All the coke-handling plant as well as the breeze screening plants is gas-driven.

The condensers form an imposing portion of the plant, consisting of forty-eight 24-inch pipes, 50 feet high, placed on end. The gas goes up one pipe and down another, alternately. The condensers are in two sections; the crude gas being split up into two streams. This "two-stream" idea is carried through to the outlet of the scrubbers, from which all the gas flows in one volume



THE GASHOLDERS AT THE BROMLEY WORKS.



PART OF THE COKE-HANDLING AND STORAGE PLANT FOR Nos. 3 AND 4 RETORT-HOUSES.

to the naphthalene extractor. From the condensers the gas passes through two Livesey washers, then through (on one stream three, and on the other two) cyanogen washers, to the two tower-scrubbers. The scrubbers for one stream of gas are filled with wood, and for the other with coke. The naphthalene extractor consists of a 36-inch pipe on end, filled with wood bundles; and "Daylight" oil is pumped round and round it. At this point, the gas is split up into five streams, each of which passes through a set of purifiers. Formerly there were six sets of coal-gas purifiers; but one of these has been converted for use in connection with the oil-gas plant—making two sets of oil-gas purifiers, one of which is erected on the overhead system. At the end of each set of coal-gas purifiers, there are two check vessels. Oxide only is used for purification; but four vessels are kept filled with lime, so that they may be brought into action should it at any time be thought desirable. The capacity of the two retort-houses is 8,000,000 cubic feet per day; and, in addition, there are four sets of Humphreys and Glasgow's carburetted water-gas plant, which, though put in as 850,000 cubic feet sets, are equal to an output of 1,200,000 cubic feet each. Thus the total possible make of the works as at present operated is about 12,500,000 cubic feet per diem.

After passing through the carpenters' and blacksmiths' shops, and an adequately equipped fitters' shop in which pretty well everything that is required can be carried out, the machinery houses are reached. In the pump-room, there are duplicate sets of pumps (which can be used for pumping tar, liquor, or water at will) of a type that is not often seen in gas-works now. Each has an engine at the end geared-up to the crank-shaft, and four pumps underneath working up and down. Other machinery in this room and in the magnificent engine room includes four sets of pumping plant for pumping Beckton gas, as well as two sets for pumping the Bromley gas from one holder to another as required, and four sets of exhausters for use in the ordinary process of gas making. Then there is a steam-pump and an Ingersoll deep-well air-pump, by the aid of which plant the whole of the water supply needed for the works is secured; and an Arrol compressor, backed up by a "Paragon" duplex press pump, for the hydraulic machinery. And it may be remarked, in passing, that this section of the works is one which is really deserving of more attention than it is possible to devote to it here.

In walking round the works, acquaintance is made with four small-gauge locomotives, and one of full gauge. The use of full gauge rails on the works is, it is stated, to be extended, though there is no idea of doing away with the narrow gauge system. Well provided laboratories contain all that is necessary for the gas-works chemist; and there is a well arranged governor-house, which is connected with the other stations of the Company by a private telegraph wire. One of the duties resting with this part of the works is the lighting and extinguishing of all the public lamps in the district served (in the region of Stoke Newington), which are operated on the Rostin pressure-wave system.

[For the three accompanying illustrations of the works and holders, we are indebted to the "Co-Partners' Magazine" of the Gaslight and Coke Company.]

After the inspection, the party were entertained at tea in the shooting gallery attached to the works.

The PRESIDENT (Mr. D. J. Winslow) subsequently said that so many members turning out in spite of the bad afternoon showed a good spirit in the Association. They were greatly indebted to the Company for the privilege of seeing such an important works. One or two features they had seen—for instance, a set of pumps put up by the old Imperial Company in 1873, which had been running ever since, and the elaborate ironwork connected with it—showed that the engineers of that time had an eye for the artistic. Then the magnificent iron bridge spanning the Bow Creek, inside the works, did something to explain the heavy capital charges on some of these old works. Another point was the pan breeze washers, which practised economy, and were earning money for the Company. Failing this treatment, pan breeze was a "drug," and was simply carted out on to the works and stored there, in case of being wanted. The two sets they had seen formed a very big item of gain to the Company. They felt very grateful indeed to Mr. Birkett and Mr. Grogono.

Mr. S. A. CARPENTER (Senior Vice-President) proposed a vote of thanks to Mr. R. Birkett and his Assistant for giving up their time to the Association. The visit had been of special interest to him (Mr. Carpenter) on account of the fact that his father (now of Dorking) had spent a considerable time at these works; while his grand uncle, Mr. Stephen Carpenter, had passed the whole of his working life there.

Mr. E. G. STEWART, in seconding, said they came to the works that afternoon in good numbers because they knew there were interesting things to be seen. It was a great privilege to visit a works of such an extent. They appreciated heartily the hospitality extended them.

Mr. BIRKETT, in responding, said he was much obliged to them for their kind vote of thanks; and on behalf of the Company he would like to express his pleasure at their visit to the works. He thought these visits were both pleasurable and profitable; for the visitors asked questions and made one think, and very often as a result things were altered, which was good for all of them.

Ammoniacal Liquor for Wood Preservation.—A patent has been taken out for France by M. Kuhn for a process for preserving wood. According to an abstract of the specification in the "Journal of the Society of Chemical Industry," the wood is impregnated for 24 to 36 hours in hot ammoniacal liquor. To obtain a greater degree of preservation, the wood, while it is still hot and wet after this process, may be introduced and allowed to cool completely in a bath of ordinary preservatives, such as mixtures of crude creosote with zinc chloride, or the like.

Galvanized Water-Pipes.—The question of possible danger to health by the use of iron water-pipes coated on the inside with zinc is raised by Dr. J. Drost in the "Zeitung für Blechindustrie." According to an abstract of the article given in the "Ironmonger," a sample of water used in a country house near Hanover contained 32·4 milligrammes of zinc oxide per litre, so that the water became milky on boiling, and the oxide was deposited on the sides of kettles, or worse on eatables being cooked in saucepans. Several members of the family suffered from stomach trouble. Another case of a domestic water supply contaminated by zinc compounds occurred in Schleswig-Holstein. In this case, attention was drawn to the water supply being at fault by the fact that the owner's horses would not drink in the morning until pumping had been continued for some time. Dr. Drost was entrusted with the examination of this sample, and instituted experiments as to the solubility of zinc in water as usually supplied for domestic purposes. Zinc dissolves in any water of acid reaction, even if this is very slight, and in water containing gases such as oxygen and carbon dioxide or a mixture of them. The more acid a water is or the more gases it contains, the more zinc will it dissolve. If nitric acid comes in contact with zinc, it is reduced to quite an appreciable extent to nitrous acid—a substance usually looked upon as denoting a bad drinking water.

TESTING METERS REMOVED FROM SERVICE.

Use of Saturated Gas Instead of Air.

As briefly mentioned in the account of the proceedings at the last annual meeting of the American Gas Institute which appeared in the "JOURNAL" for Nov. 5, the Committee on Consumers' Meters presented a report in which it was suggested that the use of saturated gas instead of air for testing meters removed from service was worth consideration, for the reasons set forth by the Committee. It seemed desirable to them that an investigation of the matter of testing meters should be made, because the general experience had been that on successive testings of those removed from service, using air as the medium, a constant result could not always be arrived at—the tendency being for the meters to become progressively faster after each successive test. They therefore submitted their report and recommendations, based on data already obtained when using air, illuminating gas, and gas saturated with suitable vapours at the testing-room temperature.

In their introductory remarks, the Committee point out that, though the manual operation of testing meters is itself quite simple, accuracy is dependent not only upon the perfect calibration of the proving instrument in the first instance, but requires that the volume of the medium used in measuring should remain unchanged during its transfer from the prover and its passage through the meter. Uniformity of temperature of the meter under test, of the medium, and of the testing apparatus is deemed imperative. The two considerations principally involved in obtaining the correct proof of meters are uniform temperature and constant vapour tension. By the latter, the Committee mean (in so far as the testing of meters is concerned) constancy of the proving medium throughout the operation. This medium may be air, illuminating gas, or prepared gaseous mixtures. But whatever the measuring medium may be, it would appear that it should be saturated with water vapour at the temperature of the prover, and should remain so throughout a given operation of testing a meter. Attention should be paid to the fact that change in pressure affects the vapour content, and hence the volume of the saturated gaseous medium, and also that a medium which is not saturated with water vapour tends to saturate itself while in the prover, and hence increases its original volume at the temperature of the room. The Committee give details of the construction of the prover, and then proceed as follows.

With the object of determining the comparative value not only of gas and air, but also of each of these media, when saturated prior to their entrance into the prover, a saturator was constructed consisting of a container filled with sponges, into which was introduced the saturating liquid. This device was fitted with baffles in order to ensure complete saturation, and was connected to the inlet of the prover, so that the air or gas used as the medium could be drawn through prior to its entrance into the prover. With the use of this apparatus the Committee were enabled to prove meters using (1) air, (2) air saturated with water vapour, (3) air saturated with condensate vapour, (4) gas, (5) gas saturated with water vapour, and (6) gas saturated with condensate vapour. The condensate used was some removed from other meters at that time, and was regarded as representative of the liquor found ordinarily in the meters. The following are percentages of the increase in the volume of the medium caused by its passage through meters.

Proving Medium.	Non-Dipping. Not Over Five Years Old.		Non-Dipping. Not Over One Year Old.		Non-Dipping. Over Ten Years Old.	
	1st Test.	2nd Test.	1st Test.	2nd Test.	1st Test.	2nd Test.
Air.	0·48	0·54	0·85	0·71	1·16	0·88
Gas	0·20	0·21	0·17	0·30	−0·25	−0·24
Saturated air (water) . .	1·05	0·88	1·25	1·10	1·06	0·78
Saturated gas (water) . .	0·35	0·31	0·29	0·25	0·41	0·41
Sat. air (condensation) .	0·50	0·43	0·53	0·46	0·49	0·48
Sat. gas (condensation) .	0·23	0·15	0·03	−0·01	0·15	0·10

The change in volume, it will be noted, is much less in the tests in which gas saturated with vapours of condensation was used than in any of the other tests.

A summary of the results obtained shows the average increase in volume when ordinary atmospheric air was used to have been 0·84 per cent. on the first run, and 0·72 per cent. on the second run. Nearly half of these meters showed an increase of 1 per cent. or more; the average of the "ten year" meters being 1·16 per cent. One meter showed an increase of 1·87 per cent. The average increase in volume when ordinary gas was used was but 0·04 per cent. on the first run, and 0·09 per cent. on the second run. But with gas it was found that in the case of one-third of the meters there was a slight decrease in volume. It was noticed that, whereas with ordinary air the increase in volume was greater with the older meters, with gas the older meters showed, as a rule, a slight decrease in volume.

The use of either air or gas, saturated with meter condensate, gave the best results. Not only was the average net change in volume less, but the changes in the different meters were within smaller confines. With saturated air the average error was but 0·51 per cent. on the first run, and 0·48 per cent. on the second; while with saturated gas the average error was 0·14 per cent. on the first run, and 0·09 per cent. on the second. Furthermore, it developed that the second test of meters for accuracy of registration was in closer agreement with the first test where the medium used had been saturated with gas condensate. The data obtained in the experiments made when using only water as a means of saturation were confusing, and would seem to indicate that a very complex question of vapour tensions was involved.

It is a well-established fact that, when air is used in the ordinary way as the testing medium, successive tests of meters removed from service show progressively faster with each test in the vast majority of cases. This is due, no doubt, to the absorption by the testing medium of the volatile condensate with which the meter diaphragms are more or less saturated. The effect of this absorption or evaporation is to slightly harden the leather; causing a reduction in the capacity of the diaphragms per revolution of the tangent. This gradual hardening of the diaphragms in turn causes the meters to become faster on each successive test, until the diaphragms have given off all the volatile liquids with which they were saturated. This effect is produced on both dipping and non-dipping meters, but to a smaller extent on the former, when either air from the testing-room or gas from the shop piping system is used as the medium, and no attempt has been made to saturate it.

In order to determine the effects of air, of gas, and of saturated gas upon the proofs of meters removed from service and tested under the usual conditions to be met with in a properly maintained meter-shop, an investigation of the subject was conducted, on a practical working scale, in a large city where a mixed coal and carburetted water gas was supplied to the consumers. No attempt was made to obtain other than the usual care exercised under every-day working conditions in proving the meters. The proofs of all meters showing an error of 10 per cent. or less, removed from one section of the city during three months and from another section during a period of four months, were included in the compilation of the data, as summarized and here shown in tabular form. In order to obtain results along parallel lines, alternate meters as received from service were proved with air and with gas, or with saturated gas. Each meter received a second test immediately following the first. The second test was to show the comparative variation between the two proofs when using air, gas, and saturated gas as the medium.

Having obtained the summaries tabulated, a comparison of which will show the marked tendency for meters tested with air to show faster proofs than those tested with gas or with saturated gas, it became necessary, in order to determine the comparative merits of the media employed, to endeavour to determine which gave the closest result to the actual proof of the meters at the

Average Net Errors of First and Second Proofs of Meters Removed from Service.

[(*a*) faster; (*b*) slower.]

Date of Removal.	Class.	Air.				Saturated Gas.				Difference due to Use of Saturated Gas.	
		No. of Meters.	1st Test. Per Cent.	2nd Test. Per Cent.	Difference on 2nd Test. Per Cent.	No. of Meters.	1st Test. Per Cent.	2nd Test. Per Cent.	Difference on 2nd Test. Per Cent.	1st Test. Per Cent.	2nd Test. Per Cent.
July and August, 1911.	No. 1	280	−0·29	+0·42	0·71 (*a*)	285	−1·79	−1·57	0·22 (*a*)	1·50 (*b*)	1·99 (*b*)
	No. 2	191	−1·12	−0·55	−0·57 (*a*)	169	−1·14	−1·19	0·05 (*b*)	0·02 (*b*)	0·64 (*b*)
	No. 3	439	−0·78	−0·20	0·58 (*a*)	411	−1·10	−1·17	0·07 (*b*)	0·32 (*b*)	0·97 (*b*)
September, 1911.	No. 1	58	−0·90	−0·71	0·19 (*a*)	60	−1·82	−1·91	0·09 (*b*)	0·92 (*b*)	1·20 (*b*)
	No. 2	128	−0·92	−0·19	0·73 (*a*)	103	−0·73	−0·94	0·21 (*b*)	0·19 (*b*)	0·75 (*b*)
	No. 3	295	−1·04	−0·38	0·66 (*a*)	274	−1·39	−1·79	0·40 (*b*)	0·35 (*b*)	1·41 (*b*)
Nov. and Dec., 1911. Jan. and Feb., 1912.	No. 1	232	+1·08	+1·90	0·82 (*a*)	225	+0·89	+0·52	0·37 (*b*)	0·19 (*b*)	1·38 (*b*)
	No. 2	428	−1·23	−0·79	0·44 (*a*)	428	−1·49	−2·27	0·78 (*b*)	0·26 (*b*)	1·48 (*b*)
	No. 3	1267	−0·85	−0·42	0·43 (*a*)	1221	−1·44	−2·01	0·57 (*b*)	0·59 (*b*)	1·59 (*b*)

Notes.—Meters in Class No. 1 are non-dipping; those in Classes Nos. 2 and 3 are dipping. The gas used for the first group of tests was saturated with condensation obtained from non-dipping meters; that used for the second group was taken direct from the service-pipes into the prover; and that used for the third group was saturated with 90 per cent. benzol.

time of passing gas just previous to their removal from the consumers' premises. With this object in view, ten five-light meters which had been in constant daily service in one place for a period of seven months (each meter having passed about 24,000 cubic feet of gas during that time) were selected. They were tested with gas immediately upon removal, and under conditions, both as to gas used and as to temperature, as nearly like those under which they operated previous to removal as it was possible to attain. At the conclusion of this test, they were again tested, first with gas saturated with benzol vapour, and then with air in the ordinary manner. Under each of the three conditions of proving, each meter was given two consecutive tests. The proofs obtained when using gas and when using saturated gas were alike. When using air, however, the first proof thus obtained was not the same as the proofs obtained with gas; and on successive provings with air the meters became progressively faster. The fact that the use of saturated gas gave consistent proofs, which agreed with those of the meters under actual service conditions, while air gave widely varying proofs which did not so agree, seems to point out clearly the advisability of using as a medium gas saturated (at testing-room temperature) with water and hydrocarbon vapours which it would be likely to pick up in its passage though the prover and through the meter under test.

The ideal condition under which to test consumers' meters would be with gas similar in every respect to that which had passed through each meter just previous to its removal from the premises. It is perfectly obvious, however, that this would be an impossibility; and in lieu of obtaining such ideal conditions, a medium should be employed which would least alter the conditions inside the meters in its passage through the meters undergoing the test. Gas obtained directly from a main, or from a system of house-piping at the location of the meter-testing room, may be of almost any degree of saturation, depending upon the drop in temperature to which it has been subjected after leaving the works, and upon the opportunities presented for it to pick up vapours before being used, at a comparatively high temperature, as the medium for testing meters. Should an unsaturated gas be passed through a meter which had been operating under such temperature conditions at the time of its removal as would cause a deposition of water and hydrocarbon vapours inside it, the deposited water and the light oils would readily give up to the unsaturated gas the available vapours necessary to satisfy its vapour tension; thus affecting the volume of the medium, the condition of the diaphragms, valves, and exposed bearing surfaces, and the temperature of the medium—all tending, one way or another, to affect the proof obtained. If, on the other hand, an unsaturated gas is used as the medium, and the meter under test had been operating in conditions which caused a drying action to take place inside it, or in case the gas with which the meter had operated in service had been saturated to the same or a less degree than was the medium, little or no change would take place in conditions which would affect the proof of the meter.

With the use of illuminating gas suitably saturated at testing-room temperature, no change in the volume of the medium or in the conditions of the meter under test will occur, owing to the fact that, unless a change takes place in the temperature of the medium during its passage through the meter, it will not deposit any vapours, neither will it pick up any, for the reason that it is not hungry for any vapours which the meter condensates may be prepared to give off; and so long as the temperature does not change, there is but small probability of the liquids contained in the meter absorbing any vapours from the medium passing through it.

It would appear that the use of benzol for the purpose of saturating the gas used for proving meters removed from service does not meet all requirements, inasmuch as it is a simple hydrocarbon. The gas needs to be saturated, before entering the prover, with all the various hydrocarbon vapours, and with the water vapour which it would otherwise tend to pick up in passing through the meters under test. Meter condensation, used for the purpose, did not thoroughly saturate the gas passing over it—the reason being that the supply was only renewed at intervals; and being at the same temperature as the gas, it would not volatilize rapidly enough to completely saturate the gas. After carefully considering the question, it was decided to try the experiment of using both water and street main drip oil; the gas, together with the water and oil, to be passed through a vaporizer heated to a constant temperature by water boiling in a water-jacket.

An apparatus was constructed on the lines proposed. Gas was admitted to the saturator at the rates of 200 and 600 cubic feet per hour, after the water in the jacket had been raised to boiling point. Water and drip oil were dropped into the saturator through a sight feed. The gas left it at about 200° Fahr., and after passing through a tin condenser and about 20 feet of piping, it again attained the temperature of the surrounding atmosphere, but was found to be over-saturated with water and hydrocarbon vapours. The excess vapours carried by the gas in the form of a mist were, however, quickly deposited in flowing through an additional 10 feet of piping. By means of this inexpensive and efficient apparatus, it is possible to saturate the gas completely at the temperatures at which it may be required for use in testing meters. No further experimental work has as yet been done, using gas saturated by means of the apparatus just described. Steps, however, are being taken to equip with the apparatus all the testing-rooms of one of the largest gas companies, and to use saturated gas in proving all meters removed from service.

It is, of course, self-evident that the matter of constant medium is only of importance when testing meters—*i.e.*, when the adjustment or accuracy of registration of a meter is being determined by comparison with an accepted standard measurer, such as a meter prover. The important thing at such a time is that, whatever volume is taken as a means of making comparison, it shall remain the same when measured by the second instrument (the meter) as it was when measured by the first instrument (the prover). In the practical use of the gas-meter for registration purposes, the question of saturation is of no concern, except as to harmful effect on the diaphragms or working parts; for a meter testing correctly will register correctly the volume passing through it. That is to say, 1000 cubic feet of gas passing through the meter will show a registration of 1000 cubic feet on the index, irrespective of whether the gas was fully saturated or but partly so at the time of passing through the meter. It is only (as has been said before) where one gas-measuring instrument is compared with another, as in testing-meters, that it is essential that there should be no physical change in the volume as measured by the first prior to and until after it has been passed through the second instrument.

From the experiments made, it would appear that the use of gas for proving meters is conducive to more accurate results. It is unquestionably of less injurious effect on the interior of the meter, and also better than the use of air for the purpose. At least three of the largest gas companies now use gas for the purpose of testing meters on their removal from service; and another large company are preparing to use saturated gas for the same purpose. With proper ventilation, the use of gas offers no more objectionable features than does the use of air; while, as a matter of fact, the danger is reduced, inasmuch as the meters when proved with gas do not contain explosive gaseous mixtures, while meters proved with air do contain them. The injurious action of air upon the interior of gas-meters which have been in service is well known. It would therefore seem advisable, in connection with using gas or saturated gas for obtaining proofs of meters, to make all tests in the meter-shops with gas; taking every precaution to exclude air from the meters at all times.

The average volume of gas used in purging and in obtaining one proof of each meter in the practical testing of meters on a large scale, as previously covered in this report, was 5·36 cubic feet. The entire cost of gas, of the labour and material required in preparing a saturated gas for use in obtaining the proof of consumers' meters, should not, it is estimated, average more than 0·75 c. per meter proved. This cost would be offset, and, in addition, an increased revenue would be derived, as the direct result of testing and adjusting the meters under saturated gas. Meters tested with gas saturated with meter condensation showed a proof of 1·50 per cent. slower in the case of non-dipping, and of 0·32 per cent. slower in the case of dipping meters, than they did when proved with air. Our experiments have shown that the use of saturated gas enabled proofs to be obtained which closely agree with the actual tests of the meters while in service, and that air gave proofs which differed to a marked extent from those of meters in service. It would, therefore, seem reasonable to assume that, when using air, the non-dipping meters showed a proof of 1·50 per cent. faster than that under which the meters operated in actual service conditions, and that the dipping meters showed a proof of 0·32 per cent. faster. This being true, it would follow that in adjusting meters using saturated gas, this fast error would be eliminated; and the meter so adjusted would tend to be correct when again placed in service, while the meters proved and adjusted with air would tend to be slow, under service conditions, to the extent of the 1·50 per cent. and the 0·32 per cent. already referred to.

In view of all the various and complex conditions in connection with the operation of obtaining proofs of gas-meters, all of which tend to introduce errors in the results, we feel that it should be clearly apparent that extreme care is essential in testing meters. The most scientific and careful methods employed are productive, it seems, of only close approximations of the actual proof. There are certain rules and precautions, however, which it would appear from data presented should be observed, in order to obtain the proof of consumers' meters within the smallest degree of error, and which your Committee desire to cover in this report.

Meter-provers should be carefully constructed and calibrated. The prover bells should be of polished brass or copper (preferably copper) and should not bind at any stage of their operation. Care should be exercised to avoid sudden changes in the temperature of the air in testing-rooms, due to causes such as draughts, direct sunlight, or to mechanical means of heating. All sources of heat should be located at a distance from the provers, and radiant heat sources should be avoided in attempting to heat the room. The air should be kept highly saturated with water vapour.

When proving meters that have not been in service, the air used for the purpose should be thoroughly saturated, at testing-room temperature, with water vapour. Gas, or preferably gas which has been saturated with water vapour and with the complex hydrocarbon vapours likely to be picked up in the meters proved upon their removal from service, should be used for proving meters that have been operating under gas. When gas is used, the water in the prover tanks should not be entirely removed at any one time, unless it becomes necessary to do so in order to make repairs or alterations. When fresh water is placed in the tanks, it should be allowed to remain in contact with gas for at least twelve hours before using gas for the purpose of proving meters.

Special care should be taken to at once cap the meter outlets

upon their removal from service, and to keep the caps on the meter screws at all times while meters are in stock, except at the time of proving and testing them upon their receipt from the consumers' premises. All other accepted practices, as now embodied in present-day meter-proving in properly equipped and efficiently managed meter-shops and testing-rooms, should be very carefully observed.

DETERMINATION OF MOISTURE IN COAL.

At the Meeting of the London Section of the Society of Chemical Industry held at Burlington House on the 6th inst., under the chairmanship of Professor W. R. E. Hodgkinson, three papers were read on the estimation or determination of water. One of these referred to moisture in foods, and another, by Mr. F. H. Campbell, was also largely concerned with moisture in food products, &c., though coal was mentioned by him. Mr. Campbell's method depended on the reaction between water and calcium carbide. The third paper, by Messrs. G. N. Huntly and J. H. Coste, though on the determination of water in commercial products generally, referred more particularly to moisture in coal. The paper was based mainly on material collected by a Sub-Committee, of which Mr. G. T. Holloway was President, who reported on the determination of water in coal to the Eighth International Conference on Applied Chemistry, which was held at New York last autumn. This report has not yet been published *in extenso*. It will therefore be useful to give a summary of the paper of Messrs. Huntly and Coste, in so far as it related to the determination of water in coal. Their paper will be published later on in the "Journal of the Society of Chemical Industry."

Direct Methods.

The direct methods of determination applicable to coal are three—viz. (1) Heating the coal in a current of dry gas or in a vacuum and collecting the water vapour in calcium chloride or sulphuric acid and weighing; (2) mixing the coal with an excess of a volatile, non-miscible liquid, such as xylene, distilling, and measuring the water under the layer of xylene; (3) heating the coal directly to 130° C. by a jacket of high-pressure steam and condensing the water vapour given off for measurement.

In regard to the first method, it is not desirable to use dry air as the gas for passing over the heated coal, because at 100° C. oxidation, of which water is a product, occurs. Carbon dioxide or nitrogen properly dried is best. But if the water removed from the coal is collected and weighed in calcium chloride tubes, dry coal gas may be used with safety, provided the calcium chloride does not contain free lime. The highest result for moisture in coal is generally obtained by this method.

The second direct method consists in weighing about 50 grammes of coal into an Erlenmeyer beaker of 500 c.c. capacity, adding 200 c.c. of xylene, and heating on a sandbath until 150 c.c. of xylene have distilled over. The distillate is then collected in a measuring cylinder, which is afterwards warmed to facilitate the settlement of the water to the bottom, where its volume is measured. The lower part of the measuring cylinder is narrowed, and has a scale of 0·05 c.c. divisions.

The third method consists in the use of the steam-jacketed tube known as Crosfield's moisture determinator. The apparatus affords a works' method which should be useful where high-pressure steam is available.

Indirect Methods.

Moisture in coal is, however, more commonly determined by indirect methods, of which there are two—viz.: (1) Determination of the loss of weight on heating; (2) determination of the loss of weight on exposure under a vacuum over strong sulphuric acid, either at the ordinary or higher temperatures. The first method requires a higher temperature than is afforded by the ordinary water-oven, and the use of an oven containing in the jacket either toluene or a mixture of glycerol and water is suggested in order to obtain a temperature within the oven of 104° to 107° C. A single-walled air oven cannot be depended upon to give a uniform or constant temperature. The average results of the determinations of water in six samples of coal by loss of weight on heating were as follows:—

Sample.	I.	II.	III.	IV.	V.	VI.
In water oven	2·89	9·65	7·14	5·34	6·96	7·25
In oven heated to 104° to 107° C.	2·96	9·84	7·33	5·84	7·20	7·48

It is important, however, that coal for moisture determinations by this method should be weighed within well-fitting watch glasses, or in a suitable form of weighing bottle, in order that a large area of surface may be exposed during drying, while the substance may be closed satisfactorily during weighing. Coal does not evolve appreciable amounts of other volatile matter than water at temperatures up to 110° C. In the finely ground state, however, coal is very sensitive to the action of oxygen, and on this account the indirect method is less trustworthy than the direct methods already referred to.

The second indirect method—viz., prolonged exposure in a vacuum—is satisfactory for coal if the vacuum is so good that the pressure in the desiccator is not greater than 1 to 2 m.m., and if the sulphuric acid used to absorb the water is concentrated and has a large effective surface. The results by this method are higher than those obtained with the toluene oven.

Conclusions and Recommendations of the International Commission.

The International Commission's conclusions and recommendations in regard to the analysis of coal, are indicated by the following summary:

Conclusions.

1.—No means exist for distinguishing by analysis between added water or moisture and water of crystallization or of combination.

2.—Distinction between moisture and water of combination is probably of little moment.

3.—The best results in the determination of water are obtained when the coal is treated in an atmosphere containing no oxygen, because coal is a substance which very readily undergoes oxidation.

4.—Coal is very hygroscopic, and before being dried must be properly protected from the effects of changes of temperature or atmospheric conditions, and when dry must be protected from moist air until the determination is finished.

5.—The drying should be divided into two periods, of which the last should be much longer than the first.

6.—If, however, the initial rate of drying is very rapid, the gain of weight by oxidation may very soon exceed any loss due to very slow drying over a long period.

7.—There is no advantage in drying at temperatures above that of the atmosphere but below (say) 105° C.

Recommendations.

1.—The water should be determined after the coal has been subjected to a minimum amount of preliminary mechanical treatment. From 100 to 500 grammes of the original sample are carefully weighed and spread on a metal tray for exposure, for at least twenty-four hours, to the air of the sampling room. The tray is then re-weighed, and the change of weight calculated. The coal is then ground in a ball grinder and the water determined by one of the standard methods. Or the xylene method may be used instead of exposing the sample on a tray.

2.—For ordinary technical work coal should be dried in an oven with a good air circulation for a period not exceeding one hour at a temperature between 104° and 111° C. Two portions, of 1 gramme each, should be taken for the determination, being covered while being weighed, and the covers removed during drying. One portion should be dried for half-an-hour, and the other for one hour, and the higher of the two results should be taken.

3.—If the half-hour and one-hour results differ materially, the drying should be carried out in a current of nitrogen or carbon dioxide. This method of drying in a current of inert gas is preferable for very exact work.

4.—Drying in a vacuum over sulphuric acid has no advantage over the last method. With prolonged drying, however, the results are identical.

5.—The xylene method is worthy of serious consideration, especially for industrial purposes.

6.—Coal should always be weighed in closed shallow vessels with well-fitting lids or stoppers.

7.—Desiccators with the strongest sulphuric acid, which should be frequently renewed, are recommended.

DISCUSSION.

In the discussion which ensued on the three papers, Mr. E. Grant Hooper expressed the great indebtedness of the Society to the authors. Dr. Schidrowitz asked if the vacuum method in conjunction with heating had been tried. Mr. Philip doubted if extremely great accuracy was essential in moisture determinations except in cases when both the higher and lower calorific powers of the coal were required with great exactness. Dr. Rudolf Lessing, answering a question put by a previous speaker, said that ultimately the report of the Sub-Committee would be published in full along with the proceedings of the Conference on Applied Chemistry. He did not consider coal gas so suitable as nitrogen or carbon dioxide for use in the method of drying coal in a current of dry non-oxidizing gas. He also referred to the liability to error in the determination of moisture in spent oxide by prolonged drying at about 100° C. Mr. W. J. A. Butterfield said that for commercial purposes he doubted if there was much utility in adopting methods which had a very high degree of accuracy, as the moisture in coal was liable to considerable variations from day to day, owing to its exposure to rain or dry air in transit and storage. For research work, he preferred passing dry coal gas over the coal in a U-tube and collecting the water in a weighed double absorption tube filled with calcium chloride free from alkalinity. The method was, he believed, due to Lewis Wright. He preferred a solution of calcium chloride to toluene for the jacket of an oven in which a temperature a little above 100° C. was required. Mr. W. F. Reid referred to the variations in the quality of calcium carbide, which he thought rendered the calcium carbide methods of determining water undesirable. He also should like the authors to define the "temperature of a smoky flame," which they had given in connection with a suggestion for the drying of alumina for use as a desiccant in place of calcium

chloride or sulphuric acid. It was possible to melt platinum by means of a smoky flame.

In reply to the discussion, Mr. G. N. Huntly said that he thought the vacuum method in conjunction with heating had been referred to in the paper, though the authors had not used it. The quotation in regard to the drying of alumina at the temperature of a smoky flame had been put into the paper because, if alumina so prepared proved to be a good desiccant, it would be very useful. He imagined that by "a temperature of a smoky flame" was meant the temperature which a bunsen with checked air supply would give. He thought the exact determination of moisture in coal was a more important question in connection with commercial contracts than Mr. Philip and Mr. Butterfield had suggested. The moisture in air-dried coal varied little, and was characteristic of the description of coal.

Mr. J. H. Coste pointed out, in regard to the use of the calcium carbide method, that Mr. F. H. Campbell standardized the calcium carbide which he used when exact results were necessary.

SCOTTISH JUNIOR GAS ASSOCIATION.

Visit of the Eastern District to the Coke-Ovens at Glenboig.

In the midst of a snowstorm, members of the Scottish Junior Gas Association (Eastern District) paid a visit on Saturday afternoon to Messrs. W. Baird and Co.'s Bedlay Colliery, near Glenboig, Lanarkshire, and were shown the working of the plant used in the manufacture of coke. The turnout was not so large as had been expected. Glenboig is not very conveniently reached, and it is difficult for some of the members to go there in an afternoon and get back the same day. This fact, in conjunction with the stormy weather, no doubt accounted for the non-appearance of some of the members. The visitors were received by Mr. James Robertson (manager of the coke-ovens), who, with great geniality and courtesy, showed the party over the works, and gave elaborate and interesting descriptions of the operations.

The Bedlay Colliery, which is situated in a hollow some twenty minutes' walk from the village of Glenboig, is one of the most modern and up-to-date collieries in Scotland. The take covers an area of about 3000 acres. Sinking was commenced in March, 1905; and the coal was reached in December, 1906. Four years ago, or thereabouts, the coke-ovens were installed.

The coking plant consists of 60 Semet-Solvay four-flued ovens. These are ranged in two batteries, between them being three batteries of Babcock boilers—two boilers in each battery. The disintegrating house also occupies a central position. Each battery of ovens is served by a Darby ramming and charging machine, which is driven by a 20-H.P. slip-ring motor, with tramway-type controllers. Both rams are served by the same pair of stampers, the one receiving its charge while the other is ramming. The arrangements are such, however, that either ram can be made to serve both batteries in the event of a breakdown of one of the rams. The coke-bench, of the sloping type, is served by very effective quenchers, and there are also a number of hydrants placed at intervals along the front of the bench. After quenching, the coke is delivered on to a conveyor of the tray type, 560 feet long and 2 ft. 6 in. wide. This conveyor is of an exclusive design, made for Messrs. Baird and Co.'s collieries for the conveying of coke. Its special features are the combination of trays, axles, and wheels, the ample proportions, the lubrication of the wearing parts, and the simple substantial design of the whole. Breakdowns are almost unknown, and spill is reduced to a minimum. The coke-screens are of the shaking type, arranged to separate the coke into large nuts and breeze; each size being loaded into waggons standing on separate waggon-roads. The screens are designed specially for dealing with coke; all parts subject to the scouring action being easily renewable. Surplus quenching water is run, by way of canals, to a recovery tank; the precipitate being recovered by a dredging elevator with perforated buckets, by which it is delivered into waggons. The coke conveyor and screens are driven by a 30-H.P. slip-ring motor, and the silt-recovery by a 7-H.P. slip-ring motor.

The chimney in connection with the ovens is 150 feet high and 8 ft. 6 in. in diameter. Quenching water is obtained from a tank of 39,000 gallons capacity. The gases from the two batteries of ovens are dealt with by separate exhausters, so that they are readily controlled. The gases pass through separate mains to the tar-separators before they enter the condensers, which they do at about 140° Fahr., leaving at about 60°. The exhauster-house contains three exhausters (one acting as a stand-by), each capable of exhausting 100,000 cubic feet per hour at 50 R.P.M.; eight pumps for circulating the liquor, &c.; and an air-compressor of 70 to 80 cubic feet per minute capacity, at 30 lbs. From the exhausters, the gases pass through a common main to two ammonia scrubbers and two benzol scrubbers. The oil containing the benzol passes thence to the benzol-house, where the crude benzol is liberated by steam distillation. This is re-distilled, and the lighter oils rising are delivered into the benzol storage tank, whence the product is transported to the Company's bye-product plant at Kilsyth for rectification.

The ammonia liquor receives a preliminary heating before it enters the sulphate-house, by passing through two receptacles heated by the waste gases from the saturators. The sulphate-house equipment consists of two stills and two saturators, providing a stand-by in each case, together with the usual auxiliaries. A dryer in the ordinary acceptance of the term is not employed the sulphate being loaded into bogies over a draining table, and drying being completed on the floor. The tar plant consists of three gas-fired tar-stills, served by a chimney 100 feet high by 6 feet, two pitch pans, six fractionating tanks, a gas-purifier, &c. The tar collected from the various pipes is delivered to an underground tank adjacent to the condensers, and is thence pumped to the tar-still. The creosote oil-storage tank has a capacity of 150,000 gallons.

In conclusion, a brief description of the disintegrating plant may be given. The washed coal is conveyed from the washer to the disintegrating plant in waggons, so that any water which adheres to the coal has time to drain off. At the disintegrator-house, the waggons are tipped into a pit under the rail level, from which the coal is delivered by a bucket elevator into a pair of disintegrators; the disintegrated coal being raised by a second bucket elevator and delivered on to a conveyor of the scraper type by means of which it is distributed over a pair of cylindrical storage bunkers with conical bottoms, each having a capacity of 500 tons. The gum is fed from these hoppers on to revolving feed tables, and in turn to a conveyor 550 feet long and 18 inches wide, being finally discharged at the stamps by an automatic tipper.

At the close of the inspection, tea was served—Mr. Robertson presiding. After the repast, Mr. Alexander Bishop, of Newton Grange, on behalf of the visitors, asked Mr. Robertson to convey to Messrs. Baird and Co. their thanks for the courtesy extended to them. He also thanked Mr. Robertson for the hearty manner in which he had received them, and the lucid descriptions of the plant he had given—at the same time complimenting the Company and their employees on the splendid condition in which the works are kept. Mr. Robertson responded in suitable terms.

A Twelve Million Cubic Feet Holder for Australia.

Messrs. William Coward and Co. inform us they have received instructions from the Australian Gaslight Company, of Sydney (for whom they are the London Agents), for a gasholder of a capacity of twelve million cubic feet. This enormous holder will rival, it not surpass in size, the one constructed for the South Metropolitan Company and erected at East Greenwich. The diameter will be no less than 300 feet; and it is to be provided with four lifts—the South Metropolitan holder having six. The design is the work of the Company's own Engineers at Sydney. It will be erected at Mortlake, where the new works of the Australian Gaslight Company are situated—some 8 miles from the city. This Company (the parent gas company of Australia) originally commenced operations in Darling Harbour, long since incorporated in the city itself, on land leased from the Colonial Government in 1837. The land thus obtained has, of course, enormously augmented in value, and has now been resumed on terms arranged. The inclusive operations of the Gas Company will now be conducted at the station at Mortlake. Messrs. Coward and Co. (now a limited Company) have held this important agency since the Company's initiation in the year 1837; and the present Managing-Director, whose name it bears, has been associated with it for over fifty years.

The Cleaning of a Water-Main in The Hague resulted in the removal of 4 tons 3 cwt. of rust from five miles of 12-inch pipe. The cleaning-machine comprised a small water-turbine driving four blades, which scraped the walls of the pipe. The machine was driven through the main by a head of 65 feet of water. The work is described by Heer C. H. van Spall in "De Ingenieur." Only three stoppages occurred during the operations. The first was due to a small wedge of lead in the pipe; in the second case, one of the springs which centre the apparatus on the pipe caught on the space near a joint; and in the third, the machine stopped at a socket space, allowing the water to flow around it, with consequent reduction in pressure.

The New Gas Engineer at Todmorden.—It was mentioned in the last number of the "JOURNAL" that Mr. Frederick Vernon Barnes, the Superintendent of the Eastcroft works of the Nottingham Corporation Gas Department, had been selected by the Gas Committee of the Todmorden Corporation for the position of Gas Engineer and Manager, in succession to Mr. Henry Talbot, who will leave their service at the end of the month to take up his duties at Holyhead. Mr. Barnes is a little more than thirty years of age. He received his early training under the late Mr. W. R. Chester, by whose successor (Mr. J. H. Brown) he was put first in charge of the chemical works, then of the distribution department, and finally, in 1907, of the Eastcroft works. After his appointment, the quantity of gas produced there increased from 450 to upwards of 800 million cubic feet per annum, and the make per ton of coal from 10,200 to 11,400 cubic feet. In 1908, Mr. Barnes went to Germany with Dr. W. B. Davidson, of Birmingham, to carry out tests and report upon the carbonizing of a cargo of Nottingham coal in the vertical retorts at Dessau, and also to visit and report upon the installations of similar retorts at the Mariendorf works, Berlin, and at Cologne. He is the holder of a bronze medal of the City and Guilds of London Institute for "Gas Manufacture," on which subject he has held classes at the Nottingham University College; and he has passed examinations in chemistry and other subjects. He is a member of the Institution of Gas Engineers and the Society of Chemical Industry.

REGISTER OF PATENTS.

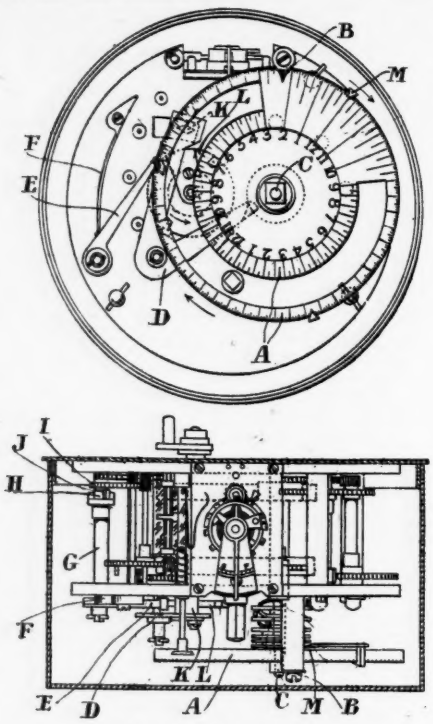
Automatically Operating Gas-Lamps.

OLIVER, C. R., of West Kensington, W.

No. 23,789 of 1911. Redated April 26, 1912.

This invention relates to apparatus for automatically operating gas-lamps at predetermined times, of the type wherein the clock or timing mechanism and the tap or switch mechanism are actuated either by separate spring barrels or motors, or by opposite ends of the same spring barrel or motor, and in which the tap actuating mechanism is unlocked or released in readiness for action a short time before the predetermined time of action, by means of a two-armed lever actuated by pins or tappets carried by the moving dial.

In certain apparatus of this class for automatically operating the lighting and extinguishing of gas-lamps, much inconvenience is (the patentee points out) caused owing to the fact that the clock mechanism employed is called upon to operate the gas-tap as well as to keep the time; hence the clock cannot be relied upon to keep correct time. In some, the operation is performed so slowly that a considerable quantity of gas is burnt in waste; and there is also great danger of the burner lighting-back. In others, owing to the rapidity with which the tap is turned, a permanent pilot is necessary; and in the case of these latter the pilot is liable to be extinguished by the air in the burner before the latter has time to light. Again, owing to the small size of the dial hitherto employed, and to the fact that many have to be released every time it is desired to alter the times of operating, an appreciable amount of time and trouble have been wasted.



Oliver's Automatic Lamp-Lighter.

The present apparatus is said to be free of these disadvantages, and the usual predetermined actions "are reliably performed, so effecting a further economy in illuminant, and likewise the time of lamp-lighters." To this end, the means for releasing the second or separate train, and for setting the apparatus to operate at the desired times, comprise: A number of flanged and slotted sleeves or collars mounted on (say) the arbor of the "second" wheel of the clock movement; movable pointers each formed with a socket, by means of which they are carried on the sleeves; snugs on the sockets of the pointers, and adapted to engage the slots in the sleeves, for the purpose of causing the sleeves and the pointers to co-act; pins or wipers on the sleeves; and an elbow-lever, one arm of which terminates in a pallet and the other in a fork, and adapted to be wiped by the pins or wipers—the entire arrangement being such that the setting of the pointers can be effected independently of each other. The improvements further comprise a peripherally notched wheel mounted on the arbor of the wheel of the second or gas-operating train, and adjustable means for masking one or more of the notches when the apparatus is to actuate more than one burner.

A front view of the complete apparatus in its case (the cover being removed) and a plan with the case in section are given.

The working of the apparatus so as to enable it to light and extinguish a lamp at predetermined times is as follows: The dial A is first set to the correct time at the moment by turning the dial round until the fixed pointer B registers with the desired graduation. One of the movable pointers is next set or adjusted to the time at which it is desired to light up—say, 7 p.m. To do this, the pointer is first released from the notch in the dial in which it happened to be at the moment, and then moved round the dial to the graduation which indicates 7 p.m., then the pointer is released and its point drops into the notched edge of the dial—the springiness of the arm drawing it down and retaining it. The second pointer is then moved round in like manner to the time—say, 3.40 a.m.—at which the light is to be extinguished. Two of the pointers having been thus set by hand, the clock-movement causes the dial to revolve in the direction of the arrows; and in so doing carries round with it the movable pointers, together with the three flanged sleeves on the arbor C. As the flanged sleeves pass slowly round, their pins come into contact successively with, and wipe against, the prongs on the elbow-lever D, so pushing it backward and causing it, in turn, to push back the detent E against the stress of the weak spring F. The detent E being connected, through the spindle G, with the stop-arm H, this latter is also thrown back, so releasing the wheel I, and thereby momentarily setting the train in motion. This momentary release allows the stop-pin J just time to get free of the stop-arm H, when the train will be again arrested by the pallet K, which then comes into the path of a stop-pin, owing to the lever D being still kept raised by one of the pins on the flanged sleeves. When, however, the pointer arrives opposite the fixed time-point B, one of the pins clears the fork of the elbow-lever, which latter then drops into its original position, so setting the train free. By the time the pin J has travelled one revolution, the stop-arm has been raised out of its path, as owing to the mutual action of the inclined extremity of the detent E, and the notch in the disc wheel L, the detent is raised or thrown out again, until it rides on the periphery of the disc, so that the train is kept in motion until the detent E drops into the next notch of the disc-wheel L, whereby the wheel I is again arrested by the stop-arm H, so operating the train which actuates the gas-tap.

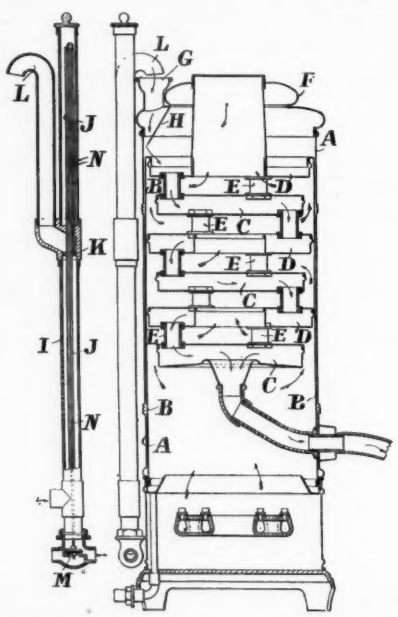
The third one (M) of the movable pointers is employed only in the case of lamps which have more than one burner, and it is desired to extinguish (say) two of them, while leaving another, or others, alight until a later time—this third pointer serving to extinguish the first light or lights.

Water Heaters.

BARRALET, J. H., of Sydenham Hill Road, S.E., and the DAVIS GAS-STOVE COMPANY, LIMITED, of Luton.

No. 25,476; Nov. 15, 1911. No. 1267; Jan. 16, 1912.

This combined invention relates to devices for controlling the supply of gas to geysers, and has for its object to improve the construction of heaters "in which the water supply passes in a narrow stream between metal surfaces connected by tubes and heated by a current of hot gases or flame which is forced to take a more or less zig-zag path."



Barralet's (Davis Gas-Stove Company) Gas Water-Heater.

As shown, the water heater comprises two concentric cylinders A B, with a narrow annular space between them forming a water-jacket. Within the jacket is a tier of shallow cylindrical and annular trays C D. The latter trays D fit the inner wall of the cylinder B and alternate with the trays C, which are smaller than the inner cylinder B. The trays are built up of two sets of similar parts—one set each consisting of an upper cylindrical dish connected by shouldered tubes E fitted with nuts to a lower annular cover; the other set of an upper annular dish connected by similar tubes E to a lower cylindrical cover. The dishes and covers are built up alternately within the inner cylinder that has an overhanging lip passing over the edge of the upper annular dish. The outer cylinder extends higher than the inner one, and is provided with a cover F, in which the water inlet G and shoot H are arranged. The shoot serves to direct the water first into the water-jacket, after which it overflows into the top tray D.

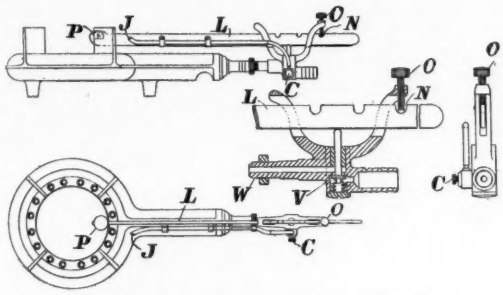
The water, before entering the geyser, is passed upwards between two vertical concentric pipes I J, and impinges upon a float ring K suspended therein. The water outlet L branches off from the outer tube I just above where the float ring is situated, and extends over the funnel-shaped inlet G of the geyser. The float is connected to the gas supply valve M by a thin rod N, which extends beyond the water outlet L and passes through the central tube J (which forms a water seal) and downwards to the gas-valve M, arranged below the tubes I J.

Gas-Burner Rings.

COAN, R. W., and MARX, C., of Goswell Road, E.C.

No. 28,238; Dec. 15, 1911.

This invention relates to a fitting for attaching to gas-burner rings and the like, whereby the gas-flame is automatically turned "off" and "on" through a lever of the second order by the action of placing or removing a vessel containing the water to be boiled on the said ring or burner. By means of an adjustable lever in the fitting, both its length from the free end to the fulcrum and the height of the free end in relation to the vessel to be heated can be adjusted to suit burners of different sizes, and the fitting is capable of attachment to any existing burner.



Coan and Marx's Automatic Heating Burner.

The illustration shows an elevation and plan of the complete burner, and a sectional and side elevation of the valve fitting.

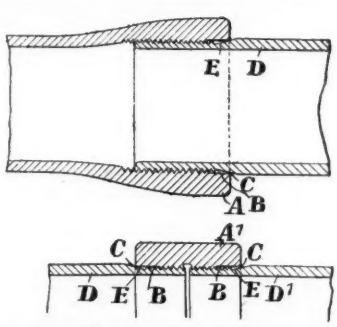
The fitting is attached to the burner by the nozzle W, the lever L is adjusted by means of the notches N to the requisite length, and the height is regulated by the screw O. The bye-pass valve C is opened and the jet J is ignited. The vessel to be heated is placed on the ring burner, and coming in contact with the projection P, on the lever L, depresses it, opens the valve V, and admits gas to the burner, which is ignited by the bye-pass jet. Upon removing the vessel, the lever L rises and shuts off the gas from the burner; the bye-pass flame being unaffected by the action of the valve V—it being separately controlled by its own valve C.

Pipe Couplings.

MOLIEN, H., of Düsseldorf, Germany, and the BRITISH MANNESMANN TUBE COMPANY, LIMITED, of Salisbury House, E.C.

No. 1666; Jan. 20, 1912.

According to this invention, the pipe to be screwed into the socket is formed behind its reduced screw-threaded portion with a conical surface adapted to bear against, and make a tight joint with, the sharp outer edge of a recess in the socket when the pipe is screwed into the latter. Two arrangements are illustrated by way of examples.



Molien's (British Mannesmann Company) Pipe Couplings.

In the first, A is the socket, which is formed at one end with an internal recess B, having a sharp outer edge C. The pipe D to be screwed into the socket is formed with a slightly conical surface E, which is adapted to bear against the sharp edge of the recess when the pipe is screwed into the socket, whereby a tight joint is made between the pipe D and the socket. The screw-thread of the pipe D is cut on the end of the pipe without upsetting or thickening the end; so that the outside of the screw-thread on the pipe has a reduced diameter compared with the conical surface E.

The second arrangement is for coupling two screw-threaded pipes D, each formed with a slightly conical surface E. For this purpose, the socket A^1 is made with both its ends alike—that is, it is formed at each end with a recess B having a sharp outer edge C.

Incandescent Gas-Mantles.

MILLER, J., of New York.

No. 28,390; Dec. 16, 1911.

This invention has particular relation to mantles which are suspended by a cord carried at the top. In order to prevent such mantles oscillating about the point of suspension, it has hitherto been proposed to fix them to the suspension means by applying, at the point of suspension, drops of one of the well-known solutions of glass, which, after evaporation and vitrification of the remaining solid, leave a small cementing film of glass. In the present invention, however, sodium silicate and a non-acid or alkaline agent, such as glycerine, are employed for retaining the mantles in plastic condition, and thus enabling the sodium silicate to be easily applied.

The composition, constituting the improved "lock" for the mantle, consists of sodium silicate (Na_4SiO_4) held in solution by a non-acid or alkaline agent, such as glycerine; the solution being produced by mixing the sodium silicate with the glycerine, by agitation of the mass, in the proportion of 5 per cent. glycerine. The solution thus produced is adapted to be conveniently applied to the suspension cord of the mantle, and will fuse under the action of heat and form a glass or porcelain-like mass, firmly cementing the cord and frame wire in a fixed connection.

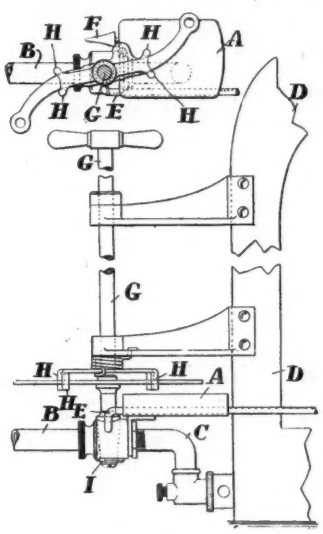
In practice, the lock may be applied to the mantle under various circumstances. For instance, the mantle may be initially manufactured in combination with the lock, by applying the composition to the asbestos suspension cord and fusing the composition to produce the lock connecting the suspension cord and frame wire before the mantle is placed in use. Or the mantle in its initial manufacture may have the asbestos suspension cord saturated with the fusing composition (by dipping or otherwise), after which the cord is covered with the usual paraffine or wax coating, whereby the fusing composition will be retained in active condition, and then when the mantle is applied in use the initial flame from the burner will melt the coating and fuse the lock composition, so as to produce the fixed andpermanent locked connection between the suspension cord and the suspension frame wire.

Gas Igniting Apparatus.

ROSTIN, H. P., of Holborn Viaduct, E.C.

No. 6690; March 18, 1912.

This invention relates to apparatus for lighting gas-burners in which mechanism is operated by the movement of the gas-cock to create sparks for lighting the gas at a bye-pass, combined with appliances whereby such gas-igniter apparatus can be operated by a handle, button, or the like, fixed at a distance from the igniting apparatus.



Rostin's Gas Igniting Apparatus.

The illustration shows a portion of a gas-fire to which is connected an igniter provided with appliances for operating the tap; also a plan of the igniter and its attachment.

A is the igniter apparatus (preferably of the kind described in patent No. 9651 of 1911). B is the gas inlet to the plug tap or cock, and C the outlet to the atmospheric tube passing to the gas-fire D. E is the bye-pass extending beyond the igniter into the gas-fire above the burners; the bye-pass tube having holes formed in it for gas to issue and be ignited when the tap is turned on.

On the gas-tap spindle is provided a nose for engaging the cone-shaped end F of the rod which (in turn) operates the igniting appliances. The upper end of the rod G is provided with a handle or lever, and its lower end carries a cross-bar formed with forks H at right angles to the cross-bar in such manner as to engage the lever mounted on the tap-spindle.

By turning the handle (which is placed at a convenient height from the floor), the lever on the cock spindle is also turned by the cross-bar and forks H until a stop I, of the usual kind, prevents any further turning movement. In this position the bye-pass is fully open, and the gas entry to the atmospheric burners slightly more than the fully open position; the gas-cock being formed with ports which communicate with the burner supply and the bye-pass respectively. The nose on the lever has meanwhile pressed upon the cone F and drawn out the igniter rod. The nose then escapes from the cone and releases the spring-controlled rod which operates the igniting appliances. The sparks produced ignite the gas issuing from the holes in the bye-pass tube E, which, in turn, lights the gas mixture issuing from the burners beneath.

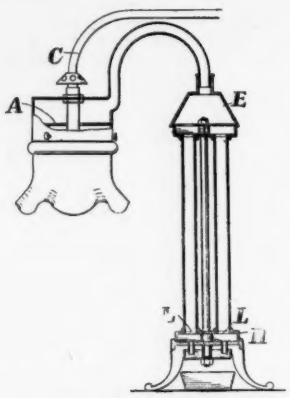
On releasing the handle, the spring which has engaged the cross-bar at the latter part only of its turning movement returns the bar and the tap lever a short distance only, so as to shut off the bye-pass port but leave the burner port fully open.

Receiving the Products of Combustion from Burners.

FOWLER, C., of Northallerton.

No. 2083; Jan. 26, 1912.

This invention relates to gas-burners provided with means for condensing the products of combustion and for conducting away any portion of the products that escape condensation.



Fowler's Burner with Combustion Products Recovery.

The burner casing has within it a partition A and an aperture through which the lower part of the gas supply pipe C is passed, and through which the products of combustion are led into the upper half of the chamber. From this chamber they pass through the U-shaped pipe into the condensing apparatus, which comprises a crown piece E arranged over a dished top plate divided into three compartments. Four tubes are connected to the top plate at their higher ends, and at their lower ends to a bottom plate H, mounted on a base. The crown piece is enclosed on its lower side except immediately over the tube L, so that the products of combustion pass down one side of the base-plate, up into the top plate, down through the other side of the base-plate, and up to the top plate, from which they escape by a suitable outlet (not shown).

The portion of the products of combustion which has condensed trickles down the insides of the tubes into the dish M, which is fixed to the condensing apparatus and which traps the fumes from escaping, as the short pipes extend down into the condensed liquid and thus seal the pipes. The overflowing liquid collects in a second dish below, which can be emptied from time to time.

LEGAL INTELLIGENCE.

MR. EDMUND EATON IN THE POLICE COURT.

South of England Natural Gas and Petroleum Company, Limited.

At the Tower Bridge Police Court last Saturday, before Mr. GILL, the Leadenhall Press, Limited, and Edmund Eaton, Colonel the Hon. Hubert V. Duncombe, D.S.O., and Daniel Wallace Heims, were summoned—the Company for printing certain booklets and circulars without imprint, and for publishing and dispersing (or assisting to disperse) them; the other defendants for aiding, abetting, counselling, and procuring the printing, and also for publishing and dispersing the documents.

Mr. R. D. MUIR (with him Mr. WILLIAM LEWIS) appeared for the Treasury; Mr. SCOTT for the Leadenhall Press, Limited; and Mr. HAROLD ELWELL represented the other defendants. Sir Charles Mathews (Director of Public Prosecutions) occupied a seat in Counsel's box, and near him was Admiral Lord Fisher.

At the outset, Mr. MUIR called for the production of the file copies of certain prints, in compliance with a notice which had been served on the Leadenhall Press, Limited.

Mr. *William Arthur Meers*, commercial traveller, in the employ of the Leadenhall Press, said he produced all the documents printed for the South of England Natural Gas and Petroleum Company, Limited, the Anglo-Russian Liquid Fuel Syndicate, Limited, and the London Industrial Contract and Finance Company, and also for Colonel the Hon. Hubert V. Duncombe, Daniel Wallace Heims, and Edmund Eaton, of 5, 6, and 9, Abchurch Yard. There were 21 of such printed documents printed between Sept. 10 and Dec. 4, 1912. Instructions as to the printing of most of them were received from Mr. E. O. Eaton—these instructions being both written and verbal. None of the documents bore the imprint of the Leadenhall Press.

Mr. SCOTT said the printers had rendered every possible assistance to the prosecution. On their behalf, he pleaded guilty to the summonses for printing. To the summonses for publishing and dispersing or assisting to disperse he pleaded not guilty.

Mr. MUIR submitted that in sending the printed documents to the other defendants the printers "published" them. To send them to the other defendants in order that they might be dispersed was to assist in "dispersing" them.

Mr. SCOTT said he was prepared, in order to shorten the proceedings, to plead guilty to all the summonses.

Mr. ELWELL, for the other defendants, pleaded not guilty.

Mr. MUIR, in opening the case, said the Act required that the name and usual place of abode or business of the printer should be set out on printed documents, with certain exceptions which did not apply to the present case. The facts which led to this prosecution were very remarkable. A booklet was issued, the outer cover reading:

> "Interesting particulars relating to the remarkable discovery of gas and petroleum in the South of England. Oil deposits in the South of England to be tapped for the future fuel supply of England's needs."

On the inner page, in large type, were the words:

> "The South of England Natural Gas and Petroleum Company, Limited. Share capital: 10,000 £8 per cent. preference shares of £1 each, 4077 ordinary shares of £1 each, 23,692 ordinary shares of 5s. each, and 40,000 profit-sharing bonds of 10s. each. Chairman, Admiral Lord Fisher, G.C.B., O.M., G.C.V.O.; the Right Hon. George Lambert, M.P.; Sir Boverton Redwood, Bart.; Sir Philip Watts, K.C.B., F.R.S.; Engineer Vice-Admiral Sir Henry John Crane, K.C.B., K.C.V.O.; Sir William Matthews, K.C.M.G.; Vice-Admiral Sir John Rushworth Jellicoe. K.C.B., K.C.V.O.; Sir Thomas Henry Holland, K.C.I.E., F.R.S.; Sir Thomas Edward Thorpe, C.B., F.R.S.; Alexander Gracie, Esq., M.V.O.; Humphrey Owen Jones, Esq., M.A.; Alfred Fernandez Yarrow, Esq."

These were names as distinguished as any in the country; and his submission was that the person who printed that document intended to mislead the public by it. These gentlemen had nothing to do with the South of England Natural Gas and Petroleum Company, Limited, had never heard of it, had made no inquiry into it, and were in no way responsible for a single statement in the document, the obvious object of which was to suggest that they were the persons really responsible for the document. Nowhere on that page did they find who were the real Directors or the real Chairman of the Company. Under this list was a line in minute type which, he suggested, could only have been so printed in order to escape observation: "The above gentlemen represent the Royal Commission appointed to inquire into the fuel supply of the British Navy." Lord Fisher had received hundreds of letters from persons in all parts of the country inquiring of him in what way he was responsible for the statements in the document; and he and his colleagues had all been subjected to great annoyance. The document went on to deal with the present quotations, and inside was a picture of the burning of natural gas, and the heading: "Information relating to this remarkable field and the South of England Natural Gas and Petroleum Company, Limited. Encouraging speech by the Chairman, Colonel the Hon. H. V. Duncombe, D.S.O." Another document, printed by the same printers, and issued by the same persons, was a circular headed "Anglo-Russian Liquid Fuel Syndicate, 6, Abchurch Yard, Cannon Street." This was signed "H. Hollis, Secretary *pro tem.*," and was in these terms:

> "We are authorized by Colonel the Hon. H. V. Duncombe, D.S.O., to enclose particulars of the parent Company formed to explore the wealth of the Sussex oil, gas, and coal fields, which have attracted considerable scientific attention recently, in view of the disclosures revealed by the preliminary borings. It is now proposed to continue the boring down to the oil-yielding formation—about 3000 feet deep—when those vast mineral deposits underlying the Company's lands, over which boring rights have been granted, in the South of England will be put to profitable account, when we will not be surprised to find these £1 shares standing at £4 premium."

The circular concluded with an offer of preference and ordinary shares which carried the right to claim an allotment of profit-sharing bonds bearing 12½ per cent. interest. In conclusion, the learned Counsel pointed out that the name of the defendant Eaton was missing from both documents.

The only witness called was

Lord *Fisher*, who said he was Chairman of the Royal Commission appointed to inquire into the fuel supply of the British Navy; and the Secretary of the Commission brought the booklet to his notice. The use of his name and those of his colleagues was not only unauthorized—it was absolutely unjustifiable. It had caused much annoyance to his colleagues. Both they and he had received a number of letters. He had put a great many into the waste-paper basket.

Mr. MUIR: Were they from persons known to you?

Witness: From persons unknown to me. Persons who knew me would not send them, you know.

Mr. MUIR: Did any of them enclose copies of this pamphlet?—Yes; I sent Sir Charles Mathews a specimen.

Mr. ELWELL said his clients desired to apologize to Lord Fisher for any inconvenience he might have been caused.

The further hearing of the case was adjourned.

Water Supply in Rural Districts.

Before the Sittingbourne County Magistrates on Monday last week, the Milton Rural District Council were summoned by Mr. Henry Boddicombe for refusing to grant him a certificate under the Public Health (Water) Act, 1878, for a house erected on the Wigmore Estate, Rainham. This estate is more than a mile from Rainham and the local water-works, and recently owners of two houses on the estate were prosecuted by the District Council for occupying them without certificates of habitation. The proceedings were the result of these prosecutions. At present, the water supply on the estate is obtained from rain water, which is collected and filtered. Mr. F. C. Boucher, the Town Clerk of Gillingham, appeared for the complainant; Mr. H. J. Bracher represented the District Council. Mr. Boucher asked for an order allowing Mr. Boddicombe to occupy the house without a certificate. Mr. J. L. Redfern, the Borough Surveyor of Gillingham, said he considered the complainant's water supply reasonable, though he admitted that it amounted to only 5 gallons per head per day, while at Gillingham the supply was 20 gallons per head. The Magistrates refused the application, with costs.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Sir Corbet Woodall.

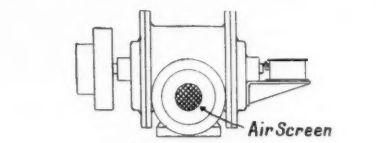
SIR,—The excellent leader in your issue of the 7th inst. on the well-merited honour to Sir Corbet Woodall, will be thoroughly appreciated, not only by the members of the gas profession, but also by a large number of those who, like myself, are old shareholders in gas companies, and who have at various times come into contact with so strong a personality at gas companies' meetings. As one also whose business brings him into constant touch with gas engineers all over the United Kingdom, I can bear witness and testify to the great esteem in which Sir Corbet is held; and his kindliness and sympathy with those of the younger members of the profession whose feet are on the lower rungs of the ladder are well known and gratefully appreciated. That the King has graciously honoured one who is so honoured by the profession, will—and must be—a source of supreme satisfaction to Sir Corbet himself; for he will feel in the autumn of his days that he has not worked and lived in vain.

A. B. BOSHER.

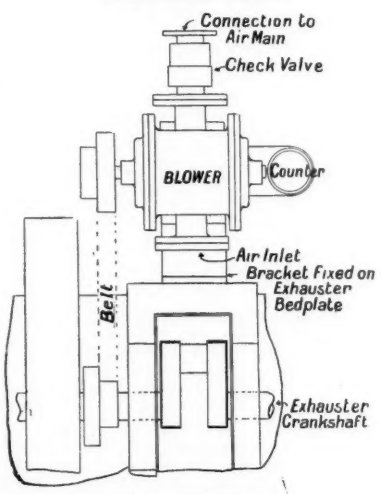
Sheffield, Jan. 11, 1913.

Purification.

SIR,—In reply to the article, entitled "Notes on Purification," in your issue of Jan. 7, I have pleasure in enclosing a sketch of the arrangement of the meter blower. The cost of the installation was £58 10s., including two No. 2 compressor type meter-blowers, automatic valves, belts, gland taps, 38 yards of 3-inch main, 3-inch valve, brackets for blowers, and all labour fixing and coupling-up.



ELEVATION OF BLOWER



PLAN SHOWING METHOD OF DRIVING BLOWER

I should like to discuss one or two points mentioned in the article. With respect to the passage: "But, as the make of gas does not, or at least should not, vary more than 10 or 15 per cent. from hour to hour, a corresponding variation in the air admission cannot be a very important point." When beds are taken up or put down, the make of gas rapidly increases or decreases; and unless the admission of air is carefully watched, the amount introduced may be altogether out of proportion. This variation may often occur at night, when most of the staff are absent, and those present are busy with the alteration in the carbonizing arrangements. Thus it may happen that next morning the boxes may be foul or overheated.

This is one of my strongest reasons for advocating the meter-blower, which automatically adjusts itself. At very large works, more members of the staff are present at night, and can thus give the matter better attention; and there is, generally, I believe, less percentage variation in the hourly make of gas in large than in medium or small works. I quite agree with the editorial comments in the "JOURNAL" for Nov. 19, that in very large works the use of meter-blowers, especially if long lengths of air-main are required, is not anything like so advantageous as in a medium or small works, where the purifiers are close to the exhauster house.

As to internal revivification, I am glad to notice that the writer of the article finds it an advantage to make the box to be emptied the last taker for some hours before lifting the lids, thereby minimizing the chance of firing, and rendering the emptying operations less objectionable, as was first suggested by my father, Mr. H. Townsend, in a letter which appeared in your columns on July 16, 1911.

CHAS. V. TOWNSEND.

Wakefield, Jan. 9, 1913.

The Meeting of the Association of Belgian Gas Engineers.

SIR,—I was very much surprised upon reading the report published in your "JOURNAL" of Dec. 17 regarding the communication I presented to the Association of Belgian Gas Engineers on the 11th ult.

Allow me to point out to you that the object of my paper was to post the members regarding the work done by the Committee of the American Gas Institute on calorimetry, and I distinctly informed them that unfortunately I was not yet in possession of the 1912 report of this Committee, the conclusions of which I would present at a further meeting as a necessary sequel to my first communication.

Your correspondent either misunderstood my language or my intentions; and as his interpretation has a tendency to throw discredit on my work, I would be much obliged if you will publish the present letter.

T. A. VANDER WILLIGEN.

209, *Chaussée d'Ixelles, Bruxelles,*
Jan. 7, 1913.

Legality of "Sticking-Plaster" Receipts.

SIR,—Up to a few months ago, our gas demand notes and receipts were combined on one form. If the consumer paid on delivery of his account, the receipt at the foot was dated and signed by the collector, and the form handed to the consumer. If he did not pay, the account-receipt was brought back by the collector to the office. At my suggestion, it was decided to discontinue this system, and substitute for it separate demand notes (to be left with the consumer whether he paid or not), and separate receipt forms (4½ in. by 2½ in.); the latter being put up in book-form, progressively numbered, and duplicates obtained by means of carbon paper.

Our 80,000 consumers accepted the new method—with the exception of one, a gentleman learned in the law! He paid the collector as usual, but on seeing that the account itself had not been discharged he objected to part with his money unless the old plan of receipting the account was followed. The collector pointed to the red-ink announcement on the face of the account—viz., "Consumers are particularly requested to see that they obtain a separate official receipt for all payments made. Gas and other accounts are not to be receipted. If an informal receipt should be tendered, please decline it, and report to the Treasurer"—and explained that he could not break a rule so emphatically laid down. The upshot was that the receipt was cancelled, and the matter reported to me. I wrote to the solicitor, and pointed out that the receipt to which he had taken objection was the official and only recognized form, and that over 50,000 of our consumers had, up to the time of writing, accepted it without demnr. He replied as follows:—

> I am in receipt of your letter of yesterday enclosing account of 6s. 5d. against me, of which I tendered payment to your collector when he called here on Monday, the 16th ult., but withheld when he was not to receipt the account as was always done formerly, but by means of affixing to it a separate "sticking-plaster" receipt. Holding, as I do, legally, that such separate affixed receipts (which, if they did not fall off as I have seen them do, might easily enough be removed or even transferred to another account) do not constitute a proper, valid, legal, and unexceptionable receipt, it is my rule, as well as the rule of my firm when acting on behalf of clients, to decline them; and I do not think, if you consult your legal adviser, he can do otherwise than admit that the payer of an account is entitled to get his discharge upon the account itself. I therefore put on record that payment awaits your collector when he grants me a receipt upon the account. That 50,000, or even 100,000, gas consumers accept such receipts, does not influence me in the slightest degree.

To this missive, I sent the following rejoinder:—

> I beg to acknowledge the receipt of your letter of yesterday. I am not in a position to argue the legal point with you. All I can say is that, if your view is correct, there are many millions of illegal receipts given every year. In view of the distinct announcement on the gas demand notes that "Gas and other accounts are not to be receipted," and the explicit instructions given to the collectors, &c., to use the separate receipt form only, it would, as you will see, create a somewhat dangerous precedent if the rule were allowed to be broken.
>
> I suggest that you accept the authorized and official form of receipt provided it be pasted securely on the demand note (and not merely at the edge). This would prevent the receipt falling off or being transferred to another account. The bearer of this letter will, I think, affix the receipt to your entire satisfaction.

I instructed the bearer of the letter to take with him a pot of "stick-phast" (it struck me that this, in name, at all events, was the most suitable adhesive), and paste down the receipt so securely that nothing but prolonged soaking would permit of its being removed. I hoped that this would solve the difficulty. But no! He stuck like sticking-plaster to his point, and refused the suggested compromise. A few days passed, and then the solicitor sent a youthful messenger with the gas account (6s. 5d.), and the intimation that he was instructed to tender the cash on condition that the account itself was receipted. I politely declined to accept the money on this condition; and I also read aloud to the youth a paragraph from "Jack's Reference Book" (1912 edition, p. 633), which bore on the question of receipts:—

> If any person, where the sum paid is £2 or more, gives a receipt for less, or divides the amount so as to evade the duty, he is liable to a penalty of £10. Where a receipt would be liable to duty, and the payee refuses to give a receipt duly stamped, he is liable to a penalty of £10. It will, therefore, be borne in mind that, apart from this provision of the law, no one can be compelled to give a receipt; and in the case of a payment of less than £2, there is no power to compel a payee to give a receipt.

The youth departed, and I leant back in my chair and reflected. Was there no way of conciliating this ultra-particular consumer? Could I not think out some means of overcoming the difficulty, and so

prevent its having to be brought before the Board? My meditations resulted in the dispatch of the following epistle:—

> Your clerk called here to-day to tender payment of your gas account on condition that the account itself was receipted. As this would be contrary to the rule of the Commissioners, I declined to accept the money on this condition. It has, however, since occurred to me that the difficulty would be overcome if we were to attach the official receipt to the account and in addition discharge the account itself, marking the second discharge "Duplicate receipt." You could then destroy the attached receipt, if you thought fit to do so. If you agree to this, perhaps you would in future remit direct to me, and I will see that this arrangement is carried out."

The next day an older messenger was shown into my room. "Mr. ——— will agree to the compromise you suggest, if you will mark the separate receipt 'Duplicate,'" he said. I smiled, but it was a smile in which there was an element of sadness. "Don't you see, my friend," I remarked, "that that would be placing our official and authorized receipt in a secondary position, and would be in direct opposition to the regulation so clearly laid down? There is a principle at stake," I continued; "and though I am anxious to meet your employer, I cannot sacrifice a fundamental principle to do so." We discussed the situation a little longer, and then I said: "If I were to write on the gas account that I certify that the account was paid on such-and-such a date, and the official receipt form for 6s. 5d. issued, would that meet with Mr. ——'s acceptance?" He agreed to this proposal, I wrote the certificate on the gas bill, the official receipt was affixed, and the 6s. 5d. changed hands.

Imagine my surprise when, the following morning, Mr. —— himself called upon me! Involuntarily I gave a half-suppressed laugh. "It's no laughing matter," he observed. I agreed—and apologized. He was indignant because I had not carried out my own proposal. "Excuse me," I said, "you did not agree to my proposal." "I did, with a trifling exception." "Not trifling in my view," I answered. "I cannot consent to subordinate the official receipt form to one given against the regulations." He asked me if I did not know that a payer of an account could demand to have the account itself discharged. I replied that I was not versed in legal lore; but I should be glad if he would refer me to any Act of Parliament or judgment that supported his view. He could not do this, but remarked that it was "elementary law." His final words were: "Wait until the account is £2 or over, and then there'll be the tug of war."

My next step was to write to the Birmingham and Manchester Gas Departments (where the same system of separate "sticking-plaster" receipts is in use), and inquire if any of their consumers had objected to the method. Both replies were to the effect that the system had been in operation for many years, and that no objection had been taken to it. I sent a copy of the correspondence to Mr. ——, who replied:—

> With all due deference, I see nothing which derogates from what I have already stated—viz., that a separate receipt-slip affixed to the account itself by a very narrow gummed edge, which, so to speak, hangs by a thread, and which is easily detachable intentionally or accidentally, is anything but satisfactory; and the fact remains that these separate stuck-on so-called receipts do not form the good, sufficient, and unexceptionable discharge to which the payer of an account is entitled. However, since you have undertaken to put the necessary marking on my accounts themselves as well as the stuck-on so-called receipts, I shall be quite content with that.

At this season of the year, you will pardon the levity of this letter; and perhaps you will also be so kind as to permit me to ask whether the solicitor is right in his contentions (1) that a payer can demand to have his account receipted on the account itself, and (2) that a gummed-on separate receipt is not a legal discharge?

A. Canning Williams, Treasurer,
Edinburgh and Leith Corporations' Gas Commissioners.

25, *Waterloo Place, Edinburgh, Jan.* 6, 1913.

National Health Insurance Act.

Sir,—I attach copy of correspondence between myself and the Institution of Gas Engineers on Part II of above.

R. W. Edwards.

Aldershot, Jan. 7, 1913.

[Enclosure.]

Copy of Letter to Secretary Institution of Gas Engineers.

Jan. 4, 1913.

I beg to call your attention to decision of the Umpire (No. 1229) under Part II, National Health Insurance Act, 1912, in which contributions are stated to be payable by the following workmen:—

(1) The substitution of vertical for horizontal gas-retorts.
(2) The conversion of gasholder tanks into tar tanks.

I suggest that, as there have been so many decisions affecting gas undertakings, a detailed list be prepared by the Committee and available for members on application.

In reply, the Secretary said he would see what it might be possible to do in the direction suggested.

Coventry Gas Supply.—The increase of business in the Gas Department of the Coventry Corporation continues to be well maintained. There are now no less than 16,000 consumers of gas through prepayment meters; and the augmentation in the consumption of gas for the present financial year so far amounts to about 8 per cent. This is considered very satisfactory in view of the growth of the Electricity Department of the Corporation. With regard to the use of prepayment gas-meters, they are in considerable demand for working men's dwellings, which are much in request. In the last twelve months, 894 houses were completed locally; but even this number fell short of the actual demand.

MISCELLANEOUS NEWS.

GAS AND WATER PROJECTS FOR NEXT SESSION.

Proposed Expenditure.

The following estimates of proposed expenditure on gas and water works under powers sought in Private Bills promoted for next session appear either in the deposited estimates or in the Bills, which are now being noticed in the "Journal." The names in parentheses are those of the engineers of the respective schemes.

	Total.
Barry Urban District Council Water (Mr. E. M. Eaton)	£127,637
Dunfermline District Water (Messrs. Warren and Stuart)	146,000
Dunfermline Water (Mr. C. P. Hogg)	200,000
Ebbw Vale Water (Sir Alexander Binnie, Son, and Deacon)	120,500
Harrow and Stanmore Gas Company (Mr. J. L. Chapman)	1,100
Heathfield and District Water (Mr. W. Matthews)	2,000
Huddersfield Corporation Water (Messrs. J. H. Hanson and J. W. Armitage)	21,170
Lanarkshire (Middle Ward District) Water (Sir Alexander Binnie, Son, and Deacon and Mr. J. M'Millen)	430,000
Leeds Corporation Water (Mr. C. G. Henzell)	121,467
Lymm Urban District Council—Gas, £20,000; water, £9918	29,918
Metropolitan Water Board (Mr. W. B. Bryan)	1,205,678
Mid Kent and East Kent District Water (Mr. F. L. Bell and Messrs. Willcox and Raikes)	55,830
Mynyddislwyn Urban District Council, for the extension of gas-works	23,750
Northampton Corporation Water (Mr. F. Tomlinson)	190,000
Pontypridd and Rhondda Joint Water Board (Messrs. G. H. Hill and Sons)	8,877
South Staffordshire Water Company (Mr. H. Ashton Hill)	129,000
Windermere Urban District Council (Messrs. Willcox and Raikes)—Gas, £11,000; water, £21,000	32,000
York Corporation, for the extension and improvement of gas-works to be acquired by the Corporation	99,000

SULPHATE OF AMMONIA MARKET.

Messrs. Bradbury and Hirsch's Review for the Past Year.

The "Review of the Market for Sulphate of Ammonia" which Messrs. Bradbury and Hirsch, of Liverpool, issue annually always contains matters of interest to "Journal" readers. We have a copy of the "Review" for 1912; and from it the following particulars have been taken.

When discussing the outlook for the fertilizer trade a year ago, Messrs. Bradbury and Hirsch were able to take a decidedly favourable view; and though the trade in phosphatic manures may have been somewhat disappointing, more particularly in the United States, the trade in the staple articles in which they are more particularly interested—sulphate of ammonia and nitrate of soda—has, both in the matter of volume and in the matter of prices, proved better than the circumstances at the outset seemed to promise. Nor are they disposed to take a pessimistic view of the outlook for 1913, though a considerably larger supply of sulphate of ammonia will have to be dealt with, and though the current prices for next season's crop of sugar are substantially below those current at the end of 1911 for the 1912 crop.

Nitrate of Soda.

When endeavouring, at the end of 1911, to estimate the probable actual supply of nitrate of soda for Europe for the ensuing four months, Messrs. Bradbury and Hirsch had to take account of the fact that the visible supply was larger by 87,000 tons than that at the end of 1910. Stocks on the West Coast were about the same; but there had been a serious shrinkage in shipments to the United States during the later months of 1911, and it was by no means certain that there would not be a further shrinkage during the early months of 1912, involving possibly a corresponding further increase in the supply for Europe. There was the incentive of an advance of about 6d. per cwt. upon the price at the end of 1910 to induce larger shipments to Europe; but, inasmuch as exceptionally heavy shipments were made in January and February, 1911, it was not thought that these were likely to be much exceeded during the same months in 1912. Notwithstanding the advanced price, the possible further defection of the United States, and the 87,000 tons increase in the visible supply, Messrs. Bradbury and Hirsch did not consider that the actual supply for January-April would exceed that for January-April, 1911, by more than 100,000 tons—that is to say, that the total would exceed 1,271,000 tons. The actual supply for the four months proved to be 1,258,000 tons: Deliveries from United Kingdom and Continental ports, 1,132,000 tons; and stocks at United Kingdom and Continental ports on the 30th of April, 126,000 tons. Their estimate was therefore 13,000 tons above the actual. The increase in the actual supply was, in fact, exactly the same as the increase in the visible supply at the beginning of the year; so that the quantity shipped in 1912 and arriving before the end of April was just the same as the quantity shipped in 1911 and arriving before the end of April—a curious coincidence. But in 1912 the shipments were more evenly spread over the first two-and-a-half months,

and there was not at any time a glut of supply such as was seen in March, 1911.

Messrs. Bradbury and Hirsch were confident, however, that the increased supply which had to be contemplated would all be required, and for reasons which they gave at some length. They pointed out that though the spot price had gone up 6d. per cwt. within the year, the advance had been far less than that which had occurred in the price of any other first-class nitrogenous fertilizer; so that nitrate of soda was relatively cheaper than it was at the end of 1910. They referred to the high price of sugar as calculated to stimulate the cultivation of beet, involving something like a corresponding increase in the consumption of nitrate of soda, there being no such stimulus in 1911, when the increase upon 1910, January-April, was 38,000 tons. Moreover, owing to transit difficulties in the interior on the Continent, it was estimated that the quantity of nitrate of soda in the interior was quite 30,000 tons less than at the end of 1910, and the deficit, whatever it amounted to, would have to be made up in 1912. That their expectations with regard to consumption were amply justified is shown by figures which they gave.

From the outset deliveries were on a larger scale than were those during the earlier months in 1911, which latter did not overtake those in 1910 until May. January deliveries were 36,000 tons ahead of those in January, 1910; February, 29,000 tons; and March, 76,000 tons—making for the three months an increase of no less than 141,000 tons. There was a slight set-back in April and in June; but this was adjusted by an increase in May.

Supplies being abundant, there was, notwithstanding good demand, no attempt on the part of sellers to force the pace; the advance in January being only 1½d. per cwt.—from 10s. to 10s. 1½d. In February, however, demand being well sustained, there was an advance to 10s. 6d. March deliveries being no less than 445,000 tons—an easy record quantity for any one month in the history of the trade—sellers were able to score a further advance of 6d. per cwt.; the closing price being 11s. per cwt. It was not likely that this pace could be sustained through April; but towards the end of the month the price was advanced to 11s. 1½d. per cwt. In May it fluctuated between 11s. and 11s. 1½d., and throughout June it remained at the dead-level of 11s.; stocks at the end of June being 10,000 tons more than those at the end of June, 1911, and the visible supply 24,000 tons less.

During July the price remained at 11s. per cwt.; but in August, when it was seen that visible supply, in relation to that in 1911, was seriously shrinking, there was an advance to 11s. 4½d. As the shrinkage was not materially reduced in September, but was further accentuated in October, there was a further advance—to 11s. 7½d. per cwt. A shrinkage of 202,000 tons in the visible supply at the end of October, compared with that at the end of October, 1911, seemed to justify a still higher level of prices. Throughout November the price was 11s. 9d.; but in the second half of the month, interest in the forward position slackened perceptibly, owing partly to a largely increasing visible supply, and, possibly, partly to political and financial complications on the Continent; so that the tone of the spot market became less firm. The same causes were operating in December, with other causes scarcely to be defined, and there was a decline to 11s. 7½d. Nevertheless the advance within the year was 1s. 7½d. per cwt., and unprecedented in recent times. The average price for the year *ex* store in Liverpool, less 2½ per cent., works out to about 11s. 1d. per cwt., or 1s. 2¾d. above the average price for 1911.

Prices on the West Coast are per quintal, and free alongside, and those for 1912 show a satisfactory year's working. From 7s. 4½d. at the outset, there was an advance to 7s. 5d. in January; but in February there was a set-back to 7s. 3½d. The price became 7s. 5d. in March, 7s. 6¾d. in April, and 8s. 1d. in May. After an advance to 8s. 2d. in June, there was a decline to 7s. 10½d. In July the price became 8s. 2½d., in August 8s. 7d., and in September 8s. 9d. From that time prices declined—to 8s. 8½d. in October, to 8s. 6¼d. in November, and to 8s. 1½d. in December. The advance within the year has thus been 9d. per quintal. The average West Coast price for January-June was 7s. 6¾d. per quintal, or 6¼d. above the average price for January-June, 1911. The average for July-December is 8s. 5⅞d. per quintal, or 9¾d. above the average for July-December, 1911. The average for the year is 8s. 0¼d. per quintal, or 8d. above the average price for 1911. The improvement in the average West Coast spot price for 1912 was 6¼d. less than the advance in the Liverpool average spot price; but when the advance in freights is taken into account, there is no great disparity between the two, and producers have no reason to grumble.

Production during the year is estimated to have been 2,542,000 tons—an increase of about 60,000 tons upon the output in 1911. The visible supply (stock and afloat) for the United Kingdom and Continent at the end of 1912 was about 984,000 tons, compared with 1,052,000 tons and 959,000 tons at the close of 1911 and 1910. The present visible supply is thus 68,000 tons less than that at the end of 1911, while stocks on the West Coast are about the same; so that from the point of view of supply the position is decidedly stronger than it was a year ago. There will be a larger output in 1913 to deal with; but Messrs. Bradbury and Hirsch think, notwithstanding increasing output and the high level of prices in Europe, that of shipments, by sail and steam, made in 1913 and arriving before the end of April, they need not count upon more than 230,000 tons. Adding this quantity to the present visible supply of 984,000 tons, they have an actual supply of 1,214,000 tons for January-April, or 44,000 tons less than the actual supply for January-April, 1912.

Assuming an actual supply of 1,214,000 tons for January-April, what, they ask, are the prospects of a commensurate demand, and what are the chances of the present level of prices being maintained over the spring season? The present situation differs in every respect from that described at the end of 1911. The then market price for the 1912 beet sugar crop was at a higher level, and one calculated to stimulate cultivation of beet on the largest practicable area—necessarily involving something like a corresponding increase in the consumption of nitrate of soda, which at that time was relatively the cheapest nitrogenous fertilizer. But there was a big increase in the actual supply of nitrate for January-April to face. To-day the current price for the 1913 beet sugar crop is relatively cheap, while the price of nitrate of soda is relatively dear—the one tending to check the cultivation of beet, and the other calculated to divert buyers to the use of relatively cheaper nitrogenous substitutes. But, as Messrs. Bradbury and Hirsch have endeavoured to show, the actual supply of nitrate of soda for January-April will probably be 44,000 tons less than the actual supply for January-April, 1912; and this must, they say, be regarded as satisfactory in view of the further consideration that the supply of sulphate of ammonia in Germany is certain to be much larger than that for the first four months of 1912. German producers of sulphate have all along expressed themselves confident about finding sufficient room on their home market for their increased supply; and there is some evidence of their sincerity in the fact that until recently they have been seen less, and not more, in the export market than in other years. It may be that they will later have to avail themselves more of the export market. In the meantime, they know that they have on their side the important fact of relative cheapness; and Messrs. Bradbury and Hirsch think it is certain that they will strain every nerve in order to place the whole of their output on their home market.

Sulphate of Ammonia.

Turning to the subject of sulphate of ammonia, Messrs. Bradbury and Hirsch remark that, when writing their 1911 "Review," they called attention to the factors which seemed to them likely to determine the course of the market over the 1912 spring months. They pointed to the record cotton crop in the United States, involving a much larger supply of cotton-seed meal for fertilizing purposes, and, consequently, a smaller demand for other fertilizers, quite apart from the indisposition of cotton growers to aim at a crop on anything like the scale of that in 1911. It was certain, therefore, that shipments of sulphate of ammonia to the United States over the early months of 1912, compared with those over the early months of 1911, would be very substantially reduced. Production in Germany had within the twelve months again largely increased, but the price current for the 1912 crop of sugar was calculated to stimulate the growth of beet sufficiently to absorb German production of sulphate of ammonia to prevent its encroaching further upon the export market. If that expectation were realized, as they believed it would be, there was every reason to expect that demand for the Colonies, and for Spain, together with a practically certain increase in demand for Japan, would sufficiently counterbalance the defection of the United States to at least maintain prices at the opening level.

The firm took an optimistic view of the situation, and the perusal of the export figures, they say, will show that they were justified in the opinions expressed. It was true that a colliers' strike, involving a big shrinkage in the output of sulphate of ammonia in the United Kingdom, drove prices to a much higher level than they anticipated; but a circumstance like this could not be foreseen or taken account of. They could only deal with the factors as they existed at the end of 1911, and assume that normal conditions would prevail over the period they had in view.

Shipments.

	Year 1912. Tons.		Year 1911. Tons.
France, Germany, and Belgium	9,539	..	10,104
Spain and Portugal, Italy, and the Canaries	83,150	..	73,794
Holland, Java, British Guiana, the West Indies, and Mauritius	52,875	..	51,114
Japan	86,659	..	76,095
United States	39,333	..	65,920
Other countries	15,308	..	14,856
Total exports	286,864	..	291,883

Home consumption during the spring months was, it is remarked, owing to inflated prices, rather disappointing; but during the autumn months there was good demand, both for prompt and spring delivery—relative cheapness being apparently the attraction.

Statistics as to Prices.

Though supplies were abundant and the level of prices high at the outset, demand was, say Messrs. Bradbury and Hirsch, keen all through the month of January; and an advance of 5s. per ton was scored. The hands of buyers were, in fact, forced, in the first place by an actual lock-out at the Lancashire cotton-mills, involving some shrinkage in the output of sulphate of ammonia, and, in the second place, by a threatened colliers' strike, which might involve a still more serious shrinkage. The lock-out, however, was not long lived, and the strike remained a threat all through February; so that, though demand was well sustained, the price declined from £14 8s. 9d. to £14 7s. 6d. per ton. With March, however, the colliers' strike became an accomplished fact, and it proved to be more general than any within living memory. Moreover, it was protracted well into April. For the first few weeks, there was no very great inconvenience—railway companies, householders, and proprietors of works having had warning, and having secured more than normal supplies of coal. But, after that, bunkers became scarce, works had to close down, carbonizers were brought to a standstill, and railway companies had to resort to restricted train services. And, in order to husband their stocks of coal, gas companies had to have recourse to a much larger use of oil for the production of gas. All this involved a serious shrinkage in the output of sulphate of ammonia, not only while the strike lasted, but for a couple of months after it was settled; supplies of coal being too scarce and too dear to permit of normal consumption. Consequently, the price of sulphate of ammonia advanced to £14 17s. 6d. per ton in March and to £14 18s. 9d. per ton in April. Supplies were scarcer in April than they were in March; but the inflated level of prices reached in March checked further buying very perceptibly, and April closed with a quiet tone.

From this time forward, the policy of buyers was to restrict their purchases as much as possible and to delay purchasing until the last moment, so that, notwithstanding smaller available supplies, the market continued to droop—to £14 15s. per ton in May, to £14 6s. 3d. per ton in June, and to £14 3s. 9d. per ton in July. In August, there was a recovery, the waiting game having been overplayed; and an active demand in the second week brought the price up to £14 10s. per ton. In September, however, weakness again prevailed, and the price dropped to £14 5s. per ton. Depression took possession of the market

in October—the long expected revival in American demand for prompt supplies not having arrived, and no adequate extra demand from other quarters being forthcoming—and £13 17s. 6d. per ton was the nearest value at the end of the month. The fact is that, after the spurt in August, while the large producers would not believe that anything could go wrong with the market, and consequently would not modify their ideas about prices in the forward position, speculators all through September and October were making heavy sales abroad, more particularly to the Southern States of America, at prices much below the equivalents of producers' prices, but for delivery over the later months of the year and over the early months of 1913. Demand having been slack during September and October, supplies were abundant in November; and, notwithstanding a well-sustained demand all through the month, the price remained practically at the dead-level of £13 7s. 6d. per ton. The heavy forward contracts had begun to mature, and had to be covered; and this became more obvious in December. From the outset there was active demand and anxiety to get contracts covered as early as possible; the latter part of the month, owing to the intervention of holidays, not being favourable for shipment. Almost immediately prices began to advance, and the railway strike on the East Coast, involving the closing of collieries and industrial works depending upon abundant coal supply, provided a further stimulus to the upward movement. The strike, however, did not last long, but long enough to disorganize every trade on the North-Eastern Railway system; and though, when the strike ceased, the market steadied down, it remained very firm at £14 5s. per ton, f.o.b. Hull, up to the end of the month.

The average price for January-June was £14 11s. 9d. per ton, or £1 1s. 4d. per ton above the average price for January-June, 1911. The average price for July-December works out to £14 3s. 8d. per ton, or 3s. 8d. per ton above the average price for July-December, 1911. The average price for the 12 months is £14 7s. 9d. per ton, or 12s. 6d. per ton above the average for 1911; and again it is necessary to go back as far as 1884 to find as high an average.

Figures of Production.

The actual output of sulphate of ammonia in Germany in 1911 proved to be 418,000 tons, against 373,000 tons in 1910—an increase of 45,000 tons. The United Kingdom contributed 385,000 tons, France 60,000 tons, Belgium 40,000 tons, the United States 125,000 tons, and Austria-Hungary and the rest of Europe 150,000 tons (estimated); so that the world's production in 1911 was something over 1,178,000 tons. Messrs. Bradbury and Hirsch thought it might be something like 1,150,000 tons; but the output from carbonizing proved to be more than they anticipated. The output in Germany during 1912 is estimated to have been 465,000 tons; that in the United Kingdom, 379,000 tons; that in France, 68,500 tons; that in Belgium, 49,500 tons; that in the United States, 165,000 tons; and that in Austria-Hungary and the rest of Europe may amount to 170,000 tons. So that the world's output during the year, according to the best estimates the authors have been able to obtain, has been nearly 1,300,000 tons—a quantity not dreamed of ten, or even five, years ago, and now more than half as much as the total output of nitrate of soda. The serious shrinkage in output in the United Kingdom in March, April, and May has been almost made good by a larger output from carbonizing works in January and February and June-December, some of which works only came into operation within the year, while others considerably extended their plant.

The production of ammonia, calculated into sulphate of ammonia (including that used in the manufacture of ammonia soda and for other chemical purposes), from all sources in the United Kingdom during 1912, is estimated at 379,000 tons, apportioned as follows:

	Tons.
Gas-works	166,000
Iron ,,	20,000
Shale ,,	61,000
Coke and carbonizing works and producer gas	132,000
	379,000

Of this quantity Messrs. Bradbury and Hirsch estimate that England contributed 255,000 tons, Scotland 121,000 tons, and Ireland 3000 tons. The production (in tons) the previous five years was as follows:

	1911.	1910.	1909.	1908.	1907.
Gas-works	169,000	168,000	164,000	165,000	165,500
Iron ,,	20,000	20,000	20,000	18,000	21,000
Shale ,,	61,000	59,000	57,000	53,500	51,000
Coke and carbonizing and producer gas	135,000	120,500	107,500	85,000	75,500
Totals	385,000	367,500	348,500	321,500	313,000

Their estimate of production in the United Kingdom in 1911 was, they say, 6500 tons under the mark. Gas-works produced 500 tons less than they anticipated, and shale-works 1000 tons more. The great difference between their estimate and the actual was in the output from carbonizing works—a rapidly developing industry about which they say it is extremely difficult to obtain very exact figures, though they gladly acknowledge the readiness and courtesy of proprietors in furnishing them with estimates in advance. In January it became obvious that their estimate of stocks of sulphate of ammonia in the hands of producers was below the mark; and from subsequent correspondence they are satisfied that they understated home consumption in 1911. It is probable that home consumption reached 89,000 tons, and that stocks in the hands of producers were as much as 16,000 tons; and if this is assumed, and their estimate of production during 1912 is correct, the account for 1912 will stand as follows:—

	Tons.
Stocks brought forward from 1911	16,000
Production during 1912	379,000
	395,000
Exports during 1912	287,000
Home consumption (for all purposes) in 1912	90,000
Stocks to carry forward into 1913	18,000
	395,000

A Glance at the Prospects.

The prospects of the market form an interesting topic; and on this subject, Messrs. Bradbury and Hirsch make the following remarks.

Seeing that the world's output in 1912 is estimated to have exceeded the output in 1911 by more than 100,000 tons, and seeing that output is still on the increase, we think we must reckon upon an increase in the world's output over the next four months, compared with January-April, 1912, of 35,000 to 40,000 tons. We think the increase in the United Kingdom between now and the end of April will probably be about 10,000 tons, partly owing to the closing-down of works in March and April last, and partly because of new plant which has come into operation in 1912; and perhaps we ought to explain that the quantity appearing as stock to carry forward into 1913 is not all actual stock, but includes somewhat large shipments made in December, but not entered out at the end of the year. What, then, are the chances of the market over the coming spring months?

Germany being now far ahead of any other country both in production and consumption, the attitude of German producers towards the market has become of first importance; and we will direct attention to it first. If we may rely on the correctness of the estimate of German production in 1912 (and we are assured that the figures supplied to us are quite reliable), it follows that in 1912 there must have been a very large increase in German consumption within the year, because, instead of there having been a substantial increase in German exports, the figures show that there has been an actual decrease. The increased output has therefore been used on German soil, except in so far as it may appear in the larger stocks to be carried forward into 1913. There is no doubt that stocks in the hands of producers were depleted at the end of the spring season; and it might well be so if German consumption, July, 1911, to June, 1912, increased by 50,000 tons upon that for July, 1910, to June, 1911, as has been stated.

Since June, German consumers have been buying more sparingly than they have done in recent years for autumn use; so that on this account, and because of the increased production, producers must be carrying forward into 1913 much heavier stocks than they have been used to carry. Of course, a large proportion of this has been sold for spring delivery; but in the meantime it is in the hands of producers. We have had occasion before to point out that since something like two-thirds of the German production is actually used within the space of about four months, the demand can only be met by accumulating adequate stocks.

With regard to the unsold portion of their output, German producers have not been showing any anxiety whatever. They are confident that supplies will all be required, and the evidence of this confidence has been seen in the fact that they have not been aggressive in the export market, as they would have been if they had had any misgivings about the disposal of their entire output. They tell us that German farmers are substituting sulphate of ammonia for nitrate of soda; but we do not see how that can have been the case up to the end of June, seeing that, while the consumption of sulphate of ammonia within the previous twelve months had increased 50,000 tons, deliveries of nitrate of soda from Hamburg had increased 96,000 tons within the same period—the rate of increase being thus practically the same. It is true that during the period in question sulphate of ammonia was relatively dear, while now it is relatively cheap; and it is reasonable to suppose that German farmers will be amenable to the logic of relative cheapness. But we are bound to say that up to the present we can see no signs of the waning of the popularity of nitrate of soda; deliveries from Hamburg, July-December, showing a very marked increase upon those for July-December, 1911.

The United Kingdom cannot look for any improved demand from the Continent—Germany, France, Belgium, and Holland; and the best that can be hoped for is that there may be no further shrinkage. A European beet crop, representing 8,935,000 tons of sugar, against 6,346,000 tons in 1911, is a fact not to be ignored; but the 1912 crop has had to fill a big gap, and when it is remembered how the crop of over 8,000,000 tons in 1910 disappeared in consumption in 1911, we do not think that beet growers need be pessimistic in regard to the 1913 crop of sugar. High prices, due to the partial failure of the 1911 crop, induced large economies in the consumption of sugar everywhere, just as was the case after the small 1908 and 1909 crops; and the lower level now reached has, with the assistance of flourishing trade and larger spending power, brought about consumption of sugar on a far more liberal scale than was the case when prices were high. Still, there will be a much larger supply of sulphate of ammonia in Germany to be got rid of.

The circumstances likely to govern the United States demand were quite exceptional at the end of 1911; and until recently the American market has been a standing puzzle to the fertilizer trade all through the year. It has constantly been reiterated that heavy stocks of compounds and material (nitrogenous and phosphatic) were brought forward from last spring season; but seeing that from July, 1911, the fertilizer trade in the United States had maintained an extremely conservative attitude in regard to purchasing material, sellers have been very sceptical about the large supplies brought forward. Certain it is, however, that until September American buyers were for the most part able to keep off the market; and then they were not concerned about prompt delivery. Heavy purchases were made in September and October, after the market had been flattened out, for November forward delivery; and the result has been seen in the November and December shipments. There is no doubt that these heavier shipments will be continued over the next three months, in order to make up for arrears; and as they will compare with much reduced shipments during January, February, and March in 1912, the difference should go far in the direction of sustaining the market. Much play has also been made in the United States with the larger supply of cotton seed meal; but in view of a shrinkage of something like 2,000,000 bales in the cotton crop, it is impossible to see where a supply of cotton seed meal nearly as large as was available over the spring of 1912 is to come from. Admittedly a smaller crop of cotton was aimed at in 1912 than was achieved in 1911, but the price of cotton is again at a level calculated to induce a cultivation approaching the scale of 1911. Whether growers will overdo the thing, as they did in 1911, may be

doubted; but we have no manner of doubt that the consumption of fertilizers in the United States over the coming season will be far ahead of the consumption over the 1912 season.

With the exception of April, May, and June, Japanese demand has been quite satisfactory, and more than anything else has helped to rescue the market from a worse fate than overtook it in the second half of the year. Shipments July-October show an increase of 7664 tons upon those for the same period in 1911. November-December shipments show an increase of only 697 tons upon those for November-December, 1911; but inasmuch as the latter were exceptionally heavy, a larger increase was not looked for. It is reported, however, that a larger proportion of the crop of Soya beans in Korea is being crushed at home than was the case last year, and that, consequently, there will be substantially more bean meal available for fertilizing purposes than was available last season. This does not promise well for sulphate of ammonia; and it will be fortunate if Japanese demand does not fall below the level of that during the first four months of 1912. We are afraid that it is hopeless to expect an increased demand.

During the first half of the year, demand from Italy was highly satisfactory; but since June there has been no improvement upon 1911. It is only fair to say, however, that July-December, 1911, shipments were rather heavy. Probably the war has interfered with business to some extent; but now that that is over, we may look for increased activity in the fertilizer trade. The Spanish demand during the first half of the year was disappointing; but since June it has been highly satisfactory. Home production now amounts to 20,000 tons per annum—about half of the quantity from carbonizing works; and the increasing use of nitrate of soda is a fact that must be faced. Until a few years ago, Spain took practically no nitrate of soda. Until 1911, she took most of her supply in parcels from United Kingdom and French ports; but in 1912 she has been taking cargoes direct, and her consumption has increased substantially within the year. Though there is now far less inducement to substitute nitrate of soda than there was twelve months ago, owing to present relative dearness, we are of opinion that nitrate of soda as a fertilizer in Spain has "come to stay," and that any large increase in demand for sulphate of ammonia from that quarter cannot safely be counted upon.

Demand for the sugar-growing Colonies within the past six months has, on the whole, been disappointing. It may be that the lower price for next season's crop of sugar discouraged buyers to some extent; but we think that the high level of prices for sulphate of ammonia in the forward position, maintained until about October, induced a postponement of purchasing, as in the case of the United States, and that, though shipments will be later than usual, the aggregate requirements of the sugar-growing Colonies will not be reduced, since cane growing is a business that must be pursued consistently year by year. It cannot be done intermittently; and, seeing that land and labour must cost about the same whether the crop aimed at is large or small, we think that the maximum will be aimed at.

There is not much elasticity about home demand, but a fairly steady increase—more particularly for chemical purposes – the use of atmospheric nitrogen compounds, for mixing purposes, tending to neutralize the natural increase in demand for fertilizing purposes.

Having regard to the relatively high price of nitrate of soda, and to the shrinkage in the actual supply for the next four months which we anticipate, and to which we have already referred, we think that Germany may be relied upon to find a sufficient market on her own ground for her large supply of sulphate of ammonia; and if Germany does not appear more prominently in the export trade, we are of opinion that increased demand for the United States, the Colonies, and Spain should be large enough to absorb the extra output in the United Kingdom at, or over, the present level of prices. If, however, German producers have mistaken the capacity of their own home demand, and if they are therefore obliged to depend more upon foreign markets, we think that United Kingdom producers may have to accept lower prices as the season advances.

The Course of the Market.

The "Review" concludes with the usual record of the course of the market month by month; and this is followed by the customary tabulated statistics. The first table contains the comparative weekly prices of sulphate of ammonia and nitrate of soda last year. In the week ending Jan. 6, sulphate was £14 5s., and nitrate £10 per ton; on April 6, the prices were £14 17s. 6d. and £11; on July 6, they were £14 5s. and £11; on Sept. 7, £14 11s. 3d. and £11 7s. 6d.; and on Dec. 28, £14 5s. and £11 12s. 6d. respectively. The second table shows the average prices per cwt. of 95 per cent. nitrate of soda, in Liverpool, for the past ten years. They are as follows; 1903, 9s. 6½d.; 1904, 10s. 2½d.; 1905, 10s. 9½d.; 1906, 11s. 4d.; 1907, 11s. 2d.; 1908, 10s. 2½d.; 1909, 9s. 9d.; 1910, 9s. 4½d.; 1911, 9s. 10¾d.; and 1912, 11s. 1d. The third table gives the average prices per ton of good grey (24 per cent.) sulphate f.o.b. Hull; the figures ranging over 46 years—1867 to 1912. The following are the averages for the past ten years: 1903, £12 9s. 2d.; 1904, £12 3s. 8d.; 1905, £12 10s. 9d.; 1906, £12 0s. 9d.; 1907, £11 15s. 8d.; 1908, £11 12s.; 1909, £11 5s.; 1910, £12 3s. 2d.; 1911, £13 15s. 3d.; and 1912, £14 7s. 9d.

Gas Purifying at Tralee.—Mr. J. E. Enright, the Gas Engineer to the Tralee Urban District Council, reported at the last meeting that, owing to leakages in the valve-box of the purifiers, he was unable to effect necessary repairs without the requisite new parts. There was a danger of having to leave the town without gas for a considerable time. He was doing all he could in the matter, pending the arrival of parts from the firm who had erected this portion of the plant. Mr. M'Cowen said the complaints about gas smells were becoming very serious. Mr. T. Slattery suggested that if the old system of purifying by lime were adopted, they might have better results. With the parts broken and the leakages, said Mr. O'Keefe, all the lime in the universe would be of no service. The fault lay, he thought, to a great extent, with the consumers, who did not keep their fittings in repair. Some of these had been in use since 1847. Notice was given of a motion for the employment of an independent engineer to ascertain what was wrong with the gas supply.

REGULATION OF AUSTRALIAN GAS COMPANIES.

The Bill as Amended.

A copy of the "Sydney Morning Herald" for the 6th ult., which is just to hand, explains the alterations made while the Bill to regulate the position of Australian Gas Companies was passing through the Legislature.

Our contemporary says: Now that the Gas Bill is at last safely on the road which leads to the Statute Book, a comparison of the measure as it has left Parliament with the Bill as introduced by the Government will be of considerable interest, as an indication of the manner in which the Government has dealt with the measure.

Price of Gas.

As the Bill was originally introduced in the Legislative Assembly, the standard price of gas was fixed at 3s. 9d. per 1000 cubic feet, so far as regards the Australian Gaslight Company and the North Shore Company, and 3s. 7½d. for the Newcastle Company. This was on the basis of a 4 per cent. standard dividend. In the Assembly, Mr. Carmichael agreed to alter the dividend to 10 per cent., but reduced the standard price to 3s. Then the Government agreed to increase the price to 3s. 3d.; and now it is 3s. 6d.—a more equitable figure. Under the original scheme, the consumer would have had no immediate reduction in price; now he will have at least 3d., while the shareholders will not suffer. The sliding-scale provisions under which the standard rate of dividend may be varied, according as the price of gas is increased or decreased, has be en amended, so as to permit an increase or reduction in the price by 1d. if the cost of production is varied, owing to an alteration in labour conditions by an award made under the Industrial Arbitration Act, 1912, or any Act amending the same. As the Bill originally stood, the whole basis on which the finances of the companies were calculated might be altered by a substantial increase in wages (such as has been recently demanded by the gas employees). It would have been manifestly unfair to adhere rigidly to a price based on altogether different working expenses.

Rate of Dividend.

The other fundamental feature of the Bill—the rate of dividend permitted to be earned—has likewise undergone radical reconstruction since the introduction of the Bill. The original proposal fixed the standard rate of dividend at 4 per cent. on the paid-up capital. The latter term was not defined in the original draft. By the Assembly's alteration, the dividend was stated to be payable on the "original" capital, which was defined as meaning "all moneys subscribed by the shareholders of a gas company as share capital in such company prior to the passing of this Act, but does not include premium capital or reserves." In its final form, "original capital" is defined as meaning "all moneys paid or to be paid or credited or to be credited as paid by the shareholders of a gas company in respect of fully or partially paid-up shares in such company issued prior to the passing of this Act, or under the provisions of section 15 thereof, but save as aforesaid does not include premium capital or reserves created after the passing of this Act." Section 15 fixes the rate of dividend at 10 per cent. on the original capital and 7 per cent. on ordinary capital, and 5 per cent. on preference capital issued after the passing of the Act.

Difference to the Shareholders.

The companies are also permitted by the alterations made by the Council and accepted by the Government to capitalize their reserves and premium capital (which will then be deemed to be "original capital" under the Act), and either distribute such reserves and premium capital in the form of fully paid-up shares among the shareholders, or issue new shares to the nominal value of the reserves and premium capital. As the Bill was introduced, the vast majority of the shareholders of the Australian Gaslight Company would have had their return on capital invested reduced from about 5 to less than 2 per cent. It should now be possible to continue the payment of the same dividend as was previously received by the shareholders. The provision now included in the Bill by section 29—enabling the companies to raise additional capital—removes from the Australian Gaslight Company a disability which is at the present moment proving a serious hindrance to the necessary extension of the Company's mains and undertaking generally.

Inequitable Burdens Removed.

The original Bill contained a host of restrictions, and placed upon the companies a number of burdens, some of which were probably unjust, and others of which were impossible to carry out. Thus, requirements necessitating the raising and expenditure of large sums of money would have been enforceable immediately on the passing of the Act. In order to give the companies a reasonable time in which to reorganize their undertakings in conformity with the provisions of the Act, the measure will now come into force on July 1, 1913, except as regards sections 15 and 29 (relating to payment of dividend, capitalization of premiums, capital, and reserves, and raising of fresh capital), which are to come into force on the passing of the Act; and as regards section 20 (fixing the standard price of gas), which will come into force on Jan. 1, 1913.

Supply of Gas.

The Bill, as introduced, contained no obligation on the part of the companies to furnish a supply of gas. They must now do so in respect of any premises situate within 25 yards from a main, and are subject to penalties if they neglect to do so. The original definition of "gas company" excluded local authorities. They are now included—subject to the qualification "which supplies gas in competition with any such company, corporation, firm, or person." The provision by which the business of a gas company might be taken over by the Government has been struck out, as has also a proviso to the effect that want of sufficient funds should not be held to be a "circumstance beyond the control of the company" exempting it from penalties under the Act.

Miscellaneous Changes.

The measure, as introduced, did not empower the companies to make any charge for the hire of meters. They may now make a charge

not exceeding 10d. per 1000 cubic feet of gas supplied. As the Bill left the Assembly, an owner or occupier might give 30 days' notice, within which time the company would be required to render a supply of gas. The period of notice is now extended to 45 days. Previously the companies were required to provide testing-places at the will of the Minister. Now the testing-places are restricted to three in number, and to be on the lands of the company. Moreover, the company is now to be entitled to "reasonable notice of any proposed testing, to permit of its due representation," and it may also demand an inquiry by a District Court Judge if it disapproves of any amendment to the method of testing as provided by the Act. The company is, under the Bill as amended, not to be bound by its obligations with regard to pressure if it is prevented by accident or by the necessity of temporarily opening or otherwise temporarily disturbing its mains for the purpose of effecting repairs to, or making connections with, such mains.

FINANCIAL PROVISIONS.

The provisions relating to the special purposes and reserve funds have also undergone substantial alteration. The special reserve fund may now comprise 2 instead of 1 per cent. of the capital of the Company, including (instead of excluding) premium capital. The previous limit to the reserve fund of 10 per cent. of the paid-up capital has been deleted, as has also the section permitting the payment of dividends out of the reserve fund. The section providing for the establishment of a divisible profits account has been altered so as to authorize the carrying forward of profits in excess of the sum necessary to pay the standard dividend, with a limitation of an amount equal to one year's standard dividend. The previous provision limited the amount of the divisible profits account available for increased dividend to 20 per cent., the remaining 80 per cent. being applied to the reduction of the price of gas.

The Views of the Australian Gas Company.

The same issue of our Colonial contemporary reported that the previous afternoon, the Board of Directors of the Australian Gaslight Company met to consider the Gas Bill, and the comments of the Minister for Education, who is in charge of the measure. At the close of the meeting, Mr. R. J. Lukey, the Secretary of the Company, stated that seemingly one of the chief complaints against the Company in the mind of Mr. Carmichael was the want of some independent control of the meters. The Minister had asserted that if a meter registered more than the consumers thought was fair, the latter had no remedy, and had to pay; but under the Bill provision was made for all meters to be tested by Government officials.

"The Gas Company," said Mr. Lukey, "is quite in accord with the testing of meters by Government officials; and the Directors have always desired some independent test. Therefore they are not surprised to find a clause of this kind in the Bill. In fact, they welcome it as satisfactory to both consumers and shareholders." But at the same time Mr. Lukey pointed out that it was incorrect to assert that the consumers in the past had had no remedy against an inaccurate meter. As a matter of fact, on the back of all accounts it was stated that should a meter be found to register in excess of 2 per cent. fast, payment for gas should be made by the consumer according to the average consumption during the corresponding quarter, month, or week. The cost of testing such fast meter, including the taking off and fixing of another meter, would be paid by the Company unless the complaint was found to be groundless. So that it was wrong for Mr. Carmichael to say that consumers were without redress.

The question of standardizing the gas pressure, and the heating power, was also referred to by Mr. Lukey, who said that the enormous growth of Sydney and suburbs had proved a difficulty to the Company; for old mains had to do duty in rapidly-growing suburbs. It could not be helped, as there was no capital for the laying of larger mains. However, the Company were now in a position to obtain capital, and new mains would be put down as speedily as possible.

"But, on the other hand," added Mr. Lukey, "I am quite prepared to say that, as far as the quality of gas supplied by the Company is concerned, I can safely say that, in respect to illumination and heating power, it has always well exceeded the standard provided by the English Acts."

Referring to the statement of the Minister that the Company had never published a balance-sheet, and that even the most up-to-date financial authority in the State did not understand the financial transactions of the Company, Mr. Lukey said: "The fact is, we have always published a balance-sheet, certainly not in the form prescribed in the English Acts, but still in a manner which was considered satisfactory to our subscribers and to the public generally."

In conclusion, Mr. Lukey stated that the Company intended pushing on with the work of supplying gas to hundreds of suburban residences by an extension of the mains in the many directions that had been asked for, but which had to be denied, owing to the hands of the Company having been tied through being unable to borrow new capital.

High-Pressure Gas at Bradford.—The Bradford Corporation Gas Committee have decided to introduce high-pressure gas for lighting in the centre of the city. The cost of the undertaking, including the laying of steel mains, is estimated at £2900. Mr. Charles Wood, the Gas Engineer, reported to the Committee that, consequent upon the many improvements which have been made in apparatus for supplying gas under high pressure, he is satisfied that the installation will be a success. It was highly recommended by other municipalities who had adopted it.

Dungannon Water Supply.—At a recent meeting of the Dungannon Urban District Council, reference was made to the condition of the water supply; it being stated that there were only some 6 feet of water in the local reservoir, while the head reservoir at Cappagh was overflowing, and that if a fire should break out in the town at night, there would be no water for the inhabitants next day. It was suggested that the pipes between Cappagh and Dungannon should be scraped; and it was ultimately decided to apply for a loan of £1500 to enable the operations to be carried out.

BIRMINGHAM GAS AND WATER ACCOUNTS.

We have received from Mr. Thomas H. Clare, the City Treasurer, a copy of the City of Birmingham financial statement for the year 1911-12. This has been issued later than usual on the present occasion, owing to the additional work involved by the extension of the city. Some of the figures contained in the gas and water accounts have already appeared in our pages.

As to the Gas Department, the revenue account shows a balance of income in excess of expenditure of £194,952 for 1911-12, carried to profit and loss account. After providing for annuities, interest, and redemption of debt, the balance of the profit and loss account was £80,681. The amount of capital expended during the year was £53,614; and the value of buildings and plant abandoned, &c., was £65,794. The total expenditure on capital account to March 31 was £2,416,282. The amount of the reserve fund provided out of revenue, with accumulations, was £100,000; while the gross total of loans negotiated, including annuities, was £2,908,949. The sum provided from revenue for redemption of debt during 1911-12 was £46,125; and the gross amount provided for redemption of debt to the end of the year was £1,029,037. The balance of loans remaining to be provided for was £1,879,912.

The revenue account of the Water Department for 1911-12 shows a balance of income in excess of expenditure of £219,710, carried to profit and loss account. The profit and loss account shows a loss of £73,098, which has been provided for as follows: Contribution from the borough rate, £65,000; transfer from capital under section 22 of the Birmingham Corporation Water Act, 1902, £4060; balance carried forward, £4038. The amount of capital expended during the year under the 1892 Act was £25,324. The total expenditure on capital account to March 31 under the 1875 and 1879 Acts was £2,097,860; and under the Act of 1892, £6,244,173. The gross amount of loans negotiated, including annuities, under the 1875 and 1879 Acts, was £2,097,860; and under the 1892 Act, £6,242,500. The amount provided from revenue for redemption of debt during the year, under the 1875 and 1879 Acts, was £19,616; and under the 1892 Act, £7962. The gross amount provided for redemption of debt to the end of 1911-12, under the 1875 and 1879 Acts and the 1892 Act, was £297,720. The balance of loans to be provided for, under the 1875 and 1879 Acts, was £1,846,094; and under the 1892 Act, £6,196,546.

GLASGOW GAS UNDERTAKING.

Meeting Increased Demands.

Mr. Alex. Wilson, the Engineer of the Glasgow Corporation Gas Department, has prepared a report dealing with the output of gas, and embodying suggestions for augmenting the plant for meeting the increased demands of consumers.

THE GAS ENGINEER'S REPORT.

There is a very large increase in the output of gas from our works for this year as compared with former years; the increase to date since June 1 amounting to 231 million cubic feet over the corresponding period of last year, which is equal to 6·18 per cent. If the increase is continued, even in a modified form, the amount of extra gas sent out during the year will be far and away the largest the department has ever had to deal with.

During the last eight years, though there has been a regular increase nearly every year, the increase, being almost entirely due to the extended use of gas cooking and manufacturing appliances, has taken place mainly during the summer months, and has not, consequently, entailed the use of much extra plant during the maximum load days of winter. This year, however, owing to the largely increased use of gas-fires and other domestic gas-heating appliances, the increase for the month of December has been practically 7 per cent., and probably would have been larger had we been able to meet promptly all the demands made by consumers for the fixing of extra gas-heating appliances, the numbers of which compared with last year at June 1 are as follows:

	June 1, 1911.	June 1, 1912.	Dec. 21, 1912.
Gas-cooking appliances (cookers, range fittings, and grillers)	78,997	100,693	123,200
Gas-fires	1,815	2,784	11,246

The output of gas referred to above is for December: Totals for first 22 days (1912), 667,088,000 cubic feet; (1911), 621,731,000 cubic feet —6·8 per cent. increase.

At the present time, our Provan and Tradeston Gas-Works are both fully employed; every retort being in action. At Dawsholm, there is still surplus plant, equal to probably an extra 4,000,000 cubic feet per day; and as there are intercommunicating mains between the various works, this surplus plant would probably carry over another winter, should no accident or breakdown occur. But in view of a further increase during the season of heaviest demand, and the necessity of providing against very cold or foggy weather, it is not advisable to risk the possibility of a short supply of gas. I would, therefore, beg to advise the Committee that the time has now arrived to proceed with further extensions of the gas manufacturing plant.

There are two or three methods by which this can be accomplished. At the Provan works, where a complete manufacturing section, capable of producing 11 to 12 million cubic feet of gas per day, has been erected, there is a large amount of ground space available for extension. It would be necessary, however, if extra retort plant were installed, to also put down all the other auxiliary plant required—viz., steam-boilers, hydraulic pumps, exhausters, condensers, scrubbers, purifiers, and station meters, with the necessary buildings; also mains for gas, steam, and water, which, for a section of similar capacity to that at present in use, would probably mean an expenditure of nearly £400,000. A large proportion of this outlay would have to be in-

curred even if a small section only of the manufacturing plant were erected in the first instance, and, consequently, the charges on capital account against the gas produced would be heavy.

The alternative method of meeting the increased demand would be to restart the gas-making plant at the Dalmarnock works. The present retorts and their accessories are, however. old-fashioned and very costly to work; and it would he better to instal up-to-date retorts, with the necessary coal-breakers, and coal and coke elevating and conveying plants, and utilize the other portions of the plant which are still intact and available for use. I refer to the boilers, exhauster, hydraulic pumps, condensers, scrubbers, purifiers, and station meters, with the buildings, mains, &c.

With the new system of vertical retorts, coal breakers, and conveyors, and also coke elevating, screening, and storing plant, and probably some small addition to the ammonia scrubbing plant, the station might be made capable of producing from 8 to 9 million cubic feet of gas per day, for which the probable cost would be somewhere between £90,000 and £100,000. About £60,000 might have to be expended for the first section; the remainder being arranged for as required.

The restarting of gas manufacture at the Dalmarnock Gas-Works would, of course, entail the appointment of a station manager and the requisite staff; but the plant, being on modern lines, would be worked with the minimum of labour, and would, no doubt, prove to be one of the most economical working stations of the department. Also, the position of the works—being practically in the centre of the city—would allow of a considerable saving being made in the cartage of coke to consumers.

It is, of course, necessary to point out that, as there are now no chemical works in connection with the Dalmarnock works, there may be a little difficulty in dealing with the liquid residuals; but this can be arranged for by erecting the necessary plant for the manufacture of sulphate of ammonia, and purchasing tank-waggons for the conveyance of the tar to one of the other chemical works, where it could be worked-up by the present staff there.

The Sub-Committee, after full consideration of the whole matter, agreed to recommend that the suggestions made in the above report in regard to restarting the manufacture of gas at the Dalmarnock Gas-Works, be generally approved, and that the Engineer be instructed to prepare the necessary plans and specifications for the new and additional plant proposed to be installed at these works. This minute has since received the sanction of the Town Council.

CHEAPER GAS AT MANCHESTER.

City Council Recommended to Make a Reduction.

For some time the Gas Committee of the Manchester City Council have been considering the question of reducing the price and an alteration in policy as to collection. At last Friday's meeting, held under the chairmanship of Mr. W. Kay, the Committee unanimously decided upon a lower charge for gas, and the adoption of the discount system. They propose a general reduction of 1d. per 1000 cubic feet, and to make a further reduction of 2d. if the account is paid within one month from the date of its delivery. The present charge to ordinary consumers within the city is 2s. 3d.; but under the new scale it will be 2s. 2d. to begin with, and 2s. if paid within the specified time. Users of gas by prepayment meters are to get 37 cubic feet for 1d., against 33 cubic feet at present; and it is intended that the new charges shall take effect as from March quarter day.

From a table prepared by Mr. F. A. Price, the Superintendent, the following are the proposed charges per 1000 cubic feet in detail:

Gas Consumed on One Premises per Quarter.	Within the City. s. d.		Beyond the City. s. d.
Ordinary consumers—			
Under 250,000 cubic feet.	2 2	..	2 5
250,000 to 1 million cubic feet	2 1	..	2 4
1 million and upwards	2 0	..	2 3
Gas-engines—			
Under 1 million cubic feet	1 9	..	2 0
1 million to 2 millions	1 8	..	1 11
2 millions and upwards	1 7	..	1 10

These prices are subject to a discount of 2d. per 1000 cubic feet for payment within one month.

	s. d.		s. d.	
Prepayment consumers	2 3	..	2 6	Net.
Public street-lamps	1 6	..	1 9	Net.
Cubic feet of gas for 1d.	37	..	33	Net.

Mr. Kay states that the recommendations to the City Council were the outcome of long and anxious consideration by the Committee. As long ago as last September the Committee began their inquiries and called for a special report on the subject from the principal officials at the Gas Department—Mr. J. G. Newbigging, the Chief Engineer, Mr. F. A. Price, the Superintendent, and Mr. F. P. Smith, the Accountant—as to the best means of revising the existing prices. He added that it was not intended to part with any of the collectors, but to find work in other ways for those who henceforth will not be required.

It is calculated that the concessions now recommended will mean about £60,000 less income for the department; but against this there will be saving in the cost of collection, the advantage of handling the money earlier, and an increase in the consumption of gas by reason of the reduced charges. The finances of the Gas Department are in a healthy condition. The Committee have reserves to the extent of £157,811, on which to draw in the event of the new departure ending in a loss.

The Gas Committee's recommendations will come before the City Council at the next meeting.

BURNLEY CORPORATION GAS SUPPLY.

Shortage through a Coal-Store Fire.

At the last Meeting of the Burnley Town Council, the Chairman of the Gas Committee (Alderman Emmott) gave an explanation of the shortage of gas which occurred shortly before Christmas. He said that on the 13th of December they found that in the new coal-store in connection with the house containing the inclined retorts the coal was on fire. There were 1300 tons in the store, and the stack was about 30 feet deep. He was given to understand that there was no way of putting out a coal-stack fire; the only way was to remove the coal. They therefore got rid of it as quickly as they could. Unfortunately, as they worked down the quality of the coal became worse; and when they came to the Saturday and Sunday preceding the 23rd of December they were making half-a-million cubic feet of gas per day less than they should have done. On the Monday morning they were in no better position; and they had to do the best they could under the circumstances. This shortage really came about through the coal strike. At that time the oil contract was running out; and as oil went up to such a high price, the Committee decided not to place another for the present. They thought they had enough coal to make all the gas required. The result was that on the 10th of December the holders were full, and they had to stop some of the retorts. Then the fire was discovered, and as they could not make as much oil gas as before, they soon lost the storage. Besides this, they had a holding capacity for only 2,800,000 cubic feet. On the 23rd of December, they sent out 3,860,000 cubic feet, and on the 25th, 3,909,000 cubic feet, which was a record. They could not make the gas fast enough. It was not likely they would ever be put in such a difficulty again. It was the first time for thirty years that they had had a fire in a coal-stack. The store was emptied during the coal strike, and they had to replenish it with what they could get. Had it been refilled at the bottom with cobs, it would have been all right; but the Committee had to take what they could get, and a good deal of it was slack. This prevented proper ventilation, and the heat set up started the fire—at a very unfortunate time. Mr. Leather (the Engineer and Manager) and his staff worked very hard in order to give a supply of gas.

DRONFIELD GAS COMPANY'S EXTENSIONS.

Opposition to the Application for a Provisional Order.

On Monday evening last week, a town's meeting was held at Dronfield to consider the application made by the Dronfield Gas Company to the Board of Trade for additional powers in respect of their undertaking. Dr. Fisher, the Chairman of the Urban District Council, who had convened the meeting, was in the chair.

The Chairman, in opening the proceedings, declared that the sole object of the meeting was to secure a reduction in the present high price of gas. He disclaimed the suggestion that the opposition was directed to depreciating the value of the Gas Company's shares. If they were to do anything to damage the Company's shares they might say good-bye to any hope of cheaper gas. The Company were applying for powers to spend a considerable sum, on which interest would have to be paid by the consumers; and if the proposed outlay did not increase the price of gas, it would make the prospect of a reduction very remote indeed. It was possible to bring Sheffield gas to Dronfield, and distribute it at a cheaper rate than that which they were charged now, besides being able to pay a bigger dividend. He felt that Dronfield ought to be attracting to it people whose presence would cause the rateable value to rise. They could offer cheap houses, healthy surroundings, and the cheapest railway facilities. Gas was their only obstacle; and so long as the present high price was charged, progress would be retarded. He explained that the opposition movement had emanated from the District Council and the surrounding Parish Councils. Referring to a letter in that day's "Sheffield Daily Telegraph," signed "Justice," he alleged that it was inspired by the Gas Company. The writer advised the ratepayers to buy out the Company. This was the very last thing that he (Dr. Fisher) would think of advising. He concluded by proposing: "That the Urban District Council be, and is hereby, requested to oppose the application for additional powers now being made to the Board of Trade by the Dronfield Gaslight and Coke Company; and that the Council adopt such measures, and incur such expense, as may be deemed advisable."

Mr. W. Gould (Vice-Chairman of the Council), in seconding the motion, said there was no idea of "scrapping" the Gas Company, as suggested by the writer of the letter in the "Telegraph." What they wanted was a public inquiry by a Government official into the whole question; and this would cost very little.

Mr. R. Pedley moved an amendment limiting the proposed expenditure to £6. He said that if the opposition were carried to Parliament the cost might reach £700. [A Voice: "£1500."] They could have gas from Sheffield at 2s. 7½d. per 1000 cubic feet, and make a substantial dividend at this figure. Why, he asked, did not the Council buy out the Gas Company at a reasonable price, and then connect up with Sheffield for gas? He was prepared to say that Sheffield would supply them for 10d. per 1000 cubic feet.

Mr. H. N. Lucas (the Chairman of the Gas Company) asked why the opposition had not approached the Directors. A new gasholder was urgently needed. In sixteen years the consumers had increased from 166 to 1342, and the demand for gas had gone up threefold. The only existing holder would contain 48,000 cubic feet; and the daily consumption was 88,000 cubic feet. In the event of an accident, Dronfield would be in darkness for weeks, if not months. "Justice" did not do justice to Dronfield, because 3s. 11d. was put down as the price of gas, and 8½d. extra for prepayment meters, whereas they were supplying a good deal of gas at 3s. 3d., and much more at 2s. 3d. It had been said that the high price of gas kept houses empty; but the

fact was there was scarcely a house to let in Dronfield. If Sheffield could be induced to supply gas, they would require an Act of Parliament to open the roads; and the Derbyshire County Council would doubtless successfully oppose this.

Mr. T. B. JONES (the Gas Company's Manager) contended that, owing to varying levels, it would be necessary to lay a trunk main and pump gas to Dronfield, if the Sheffield scheme were carried out.

The amendment was not seconded, and the resolution, with a rider limiting the expenditure to not exceeding £25, was carried by a large majority.

GAS CHARGES AND PROFITS AT BURTON-ON-TRENT.

Reductions in Price.

At the Monthly Meeting of the Burton-on-Trent Town Council last Wednesday, Alderman Lowe, the Chairman of the Gas and Electricity Committee, submitted the following motion: "That the price of gas supplied for ordinary purposes be reduced 2d. per 1000 cubic feet, for slot meters 4d. per 1000 cubic feet, and for motive power or other manufacturing purposes 1d. per 1000 cubic feet; and that the price of 1s. 3d. per 1000 cubic feet of gas for motive power or other manufacturing purposes shall apply when the quantity supplied per annum on one consumer's premises, and registered by a separate meter, is 1½ million cubic feet and upwards." Alderman Lowe said it would be remembered that on the last occasion of a reduction being made, it was given out that the case of those who had their gas through prepayment meters would be borne in mind later; and the Committee had guaranteed that, if possible, a reduction affecting them would be carried out. Prepayment meter users would now benefit by 4d. per 1000 cubic feet reduction. He had always looked forward to the time when he could stand up in the Council Chamber and announce that the price of gas to ordinary consumers would be reduced to 2s. per 1000 cubic feet. For some years the figure was 2s. 9d.; and when coal was dear it had been raised to 3s. So that the present reduction was a considerable one. The Council should bear in mind the fact that they had increased the amount voted to the rates for the last few years. In the twelve years preceding 1900, they had voted £67,000 from the gas profits; and in the twelve years following 1900, they had voted £76,000, or an increase of £9000. This was a very substantial figure. They should further take cognizance of the fact that they had also reduced the price of gas by 9d. per 1000 cubic feet, which was equal to a concession of £1500 per annum. Thus it would be seen that the Gas Committee had not been altogether unsuccessful in their efforts to improve the conditions under which gas was supplied in Burton. During the period referred to, the cost of public lighting in the town had been reduced by a further £1000 concession; and, in addition, the wages and hours of employment of the men at the works had been altered in their favour to a considerable extent. The sum mentioned was a large one; and they could view the present recommendation with a great deal of gratification. Further, he was glad to say he did not think it was the last time a reduction in the price of gas would be proposed. If they went back to the old system of applying for loans to the Local Government Board, there need be no reason, providing that the conditions of the coal market remained as at present, why they could not come again to the Council in the not far distant future with renewed proposals for reduction. He hoped they would be able very shortly to supply gas to ordinary consumers at about 1s. 8d. or 1s. 9d. per 1000 cubic feet.

The motion was carried unanimously; and the Committee were warmly congratulated upon their successful working of the gas undertaking. Much satisfaction was expressed at the reduction.

MANCHESTER AND STOCKPORT EXTENSION SCHEME.

Proposed Inclusion of Heaton Norris.

An inquiry was recently opened at Heaton Moor, by Mr. E. A. SANDFORD FAWCETT, in regard to an application made to the Local Government Board by the Corporations of Manchester and Stockport for an extension of their boundaries so as to include Heaton Norris. The Urban District Council supported the Manchester Corporation; but a section of the ratepayers endeavoured to secure the continued separate existence of the suburb.

THE CASE FOR MANCHESTER.

In support of the case for Manchester, evidence was given by Mr. J. G. Newbigging, M.Inst.C.E., the Corporation Gas Engineer, who has resided at Heaton Norris for twelve years. He stated that the Gas Department of the Corporation served an area of 47½ square miles, used nearly 497,000 tons of coal, supplied 183,793 consumers, and sold 5423 million cubic feet of gas per annum. The productive capacity of the works was being increased from 31 to 33½ million cubic feet; and the storage accommodation was much above the greatest demand. The total capital was £2,966,000, or 10s. 11d. per 1000 cubic feet; and the outstanding debt was £1,118,000, or 4s. 1d. per 1000 cubic feet of gas sold. Manchester was the lowest of the large municipal undertakings in regard to debt; and few even of the smaller undertakings were lower. The gross profits, after providing for renewals, were £195,000. Analysis had proved that the Manchester gas was better than that supplied by Stockport; and it was appreciably cheaper. In addition, the Corporation did not charge for the hire of meters, and supplied cooking-stoves free; whereas in Heaton Norris he was being charged 10 per cent. of the cost price for the hire of his cooker. There could be no doubt that the price of Manchester gas would shortly be reduced by 3d. per 1000 cubic feet. The Stockport Corporation had been filching money from the people of Heaton Norris to help to pay the rates. Manchester could supply them at 6½d. per 1000 cubic feet less than the present price, thereby saving £1516 to private consumers and £332 in street lighting. His department contributed to the rates last year a sum equivalent to 2·2d. per 1000 cubic feet of gas sold; whereas Stockport's contribution was 6·6d.

Mr. Joseph Haynes, the head of the engineering office of the Water Department, said Manchester served with water eighteen adjoining districts, including Heaton Norris; and the total area supplied was 90 square miles. A population of about 1,400,000 was dependent on the service. The city had approximately 1000 miles of pipe laid. Stockport took a million gallons a day, of which one-third went to Heaton Norris. Questioned as to complaints from Stockport about the colour of the water, Mr. Haynes said it was due to the state of the Stockport pipes. At the reservoir the water had been found to contain a pint of peaty matter per 30 million gallons. A pipe from Heaton Norris to the Thirlmere aqueduct could be constructed for about £1000.

A number of witnesses from Heaton Norris spoke in support of the application by the Manchester Corporation. The Clerk to the Urban District Council (Mr. F. W. Brooke) said that the first steps to secure amalgamation with Manchester came from the Council. Mr. Hugh Howarth, a member of the Council, said the resolution passed to open negotiations with Manchester was unanimous. Afterwards Stockport communicated with them; but they decided not to send a deputation there. Manchester offered a differential rate of 1s. 9d. on the city rate of 6s. 7·6d. Manchester had undertaken to give the Heaton Norris ratepayers within four years the same privileges in regard to gas and water supply as Manchester citizens had. The Council had had very many complaints about the water supplied by Stockport; and the quality of the gas was not satisfactory.

STOCKPORT'S CLAIM TO HEATON NORRIS.

The Town Clerk of Stockport, in the course of his evidence, stated that, with an industrial population such as it had, Stockport was entitled to support from wealthy districts adjoining the borough, and bound to it by many local ties, and developed from it. Heaton Norris at present formed the most valuable portion of the Stockport gas and water area. The income from gas was £11,941, out of a total of £97,107, and for water it was £8319 out of £58,913. He submitted that the Heaton Norris district had been recognized by Manchester as a Stockport district in the agreements which had been given under the Manchester seal in regard to both gas and water supply. Mr. Hyde explained that the million gallon of water which Manchester supplied daily to Stockport at 2¼d. per 1000 gallons was in consideration of benefits received from the borough. There was a very great danger, and he would say a probability, that Stockport would not be effectually indemnified by any compensation they might get for the loss of the gas and water supply and the prospective loss in other directions. The association of Heaton Norris with Stockport was incomparably closer than any it had with Manchester, while geographically the borough was much more favourably situated for administering the area. The Corporation were quite prepared and able to deal with all the present and future needs of the district. Witness did not think Manchester had any claim to Heaton Norris, which, in his opinion was, and always had been, a suburb of Stockport. He would not like to say that Stockport's offer was better than that of Manchester, for he should be sorry to bid, as it were, for Heaton Norris against Manchester.

Alderman Albert Johnson, an ex-Mayor of Stockport, said that geographically Heaton Norris ought to be added to the borough. He was unaware that the district had received any assistance or benefit from Manchester, except the trams and electricity in recent years. The development of the district had arisen chiefly from the enterprise of Stockport people, who were building property there fifty years ago.

Mr. S. Meunier, the Gas Engineer to the Stockport Corporation, said the consumption of gas was twice as much in Heaton Norris as in other outlying districts; and if the place were severed from Stockport it would be a great blow to the Corporation gas undertaking. If the price charged were reduced by 4d. per 1000 cubic feet—bringing it down to the rate in the borough—the loss would be £1500.

Mr. W. R. Herring considered that Stockport ought to retain the supply of gas to Heaton Norris. If it were taken over by Manchester, new mains would have to be laid. The result would be that Stockport would be injuriously affected, and additional capital expenditure would be incurred.

ATTITUDE OF THE DISTRICT COUNCIL.

At the close of the case for Stockport, the Inspector was addressed in support of the proposed annexation of Heaton Norris with Manchester. It was stated that every member of the District Council, and the great majority of those who supported them, would infinitely prefer the *status quo* to union with Stockport. The Council had come forward reluctantly; but they believed that amalgamation with Manchester could not be long deferred. Such a district as theirs could not hope to retain its independence; and if the merger must come, now was the proper time for it, the Council thought.

The chief points in the evidence given on behalf of Heaton Norris were that the gas and water supplied by Stockport were inferior, the condition of the latter being attributed to dirty mains, and that the great majority of the residents were adverse to joining the borough, and in favour of amalgamation with Manchester.

Mr. A. E. Ferns, who appeared for two local bodies who opposed the application, asked the Inspector to find that the memorials of both Manchester and Stockport had not been proved. The case put forward for Manchester by Mr. Balfour Browne had been torn to tatters by Mr. Honoratus Lloyd, who represented Stockport; and the case put forward by Stockport had been smashed to pieces by Mr. Balfour Browne. Only one course, he submitted, remained to the Inspector, and that was to report in favour of leaving the district as it was. Nothing that had taken place at the inquiry ought to cause the Local Government Board to set at naught the wishes of the people, which, he claimed, were clearly against amalgamation either with Stockport or Manchester.

The two learned Counsel just named addressed the Inspector last Thursday, and the inquiry closed.

SIR CORBET WOODALL AND HIS CO-PARTNERS.

A New Year's Greeting.

The current number of the "Co-Partners' Magazine" of the Gaslight and Coke Company opens with the following "New Year's Greeting" by the Governor, Sir Corbet Woodall, D.Sc., M.Inst.C.E.

Fellow Partners, It is Christmas Eve as I write these words—an appropriate time at which to be sending greeting to those whose well-being is very dear to me. The message brought at this season long ago was peace on "*earth*," goodwill to "*men*." Its promise was for the day. Two thousand years ago, men strove with each other as they do to-day. There were the same jealousies and envyings; then, as now, the world's need was peace and mutual goodwill.

We look, however, with thankfulness to the fact that we as a community can review the year 1912 as one of peaceful progress and hearty goodwill. Our centenary leaves many happy memories to us all; and the pleasure I derived from the several occasions on which I met the staff and workmen of the Company will never fade.

Co-partnership has further proved its value, and is, I believe, steadily drawing all sections and grades of those who serve our Company into closer association and better appreciation of each other. The members of the General Committee will, I know, endorse this. The financial position is greatly improved; £37,000 have been added to the savings of employees, and the coming year will show a still better record, because I am assured that there will be a considerable reduction in the amount withdrawn.

Looking forward, we have to face a period of great difficulty, due to the enormous increase in the price of coal, and consequently in the cost of making gas. We cannot hope for a further reduction in our charge to the consumers for some time, and consequently there can be no increase in the co-partners' bonus, nor in the shareholders' dividend. Only by the watchful and strenuous effort of all can we avoid increasing our charge; and this effort will, I am sure, be freely and gladly made.

It is said that "in adversity the good are friends most true." It is, perhaps, exaggeration to call the check to our prosperity by the term "adversity;" but it is sufficient to prove the goodness of our friendship to each other and to our principle of co-partnership.

A friend has just sent me a copy of Frederick the Great's Battle Hymn before he fought at Leuthen, and it seems to me a good motto for the year:

> Grant that with zeal and skill this day I do,
> What me to do behoves, what Thou command'st me to.
> Grant that I do it well, at point of moment fit;
> And when I do it, grant me good success in it.

May much happiness attend you and those dear to you through the coming year.

GAS AND ELECTRICITY IN GERMANY.

The "Journal für Gasbeleuchtung" quotes some interesting facts and figures from the "Leipziger Neueste Nachrichten." We give a translation of the remarks: "The question as to whether gas or electricity has the upper hand must be variously answered according to locality and needs. But it is quite out of the question to say that the use of gas for lighting, heating, and power purposes is being limited by the continually increasing number of electricity works. Both systems have their advantages as means of lighting and power supply, and can justify their existence side by side. The profits accruing from both are continually on the increase. In the current year (1912), 169 electricity and gas companies have published balance-sheets which compare favourably with those of the previous year. The total capital in stocks and shares of these companies increased roughly from 24 to 25 million pounds during the year, and the dividends paid from 1·78 to 1·97 million pounds, or an average increase in dividend from 7·4 to 7·8 per cent. The number of gas companies included in these figures is 73, and electricity companies 65. The gas dividends show an increase from 9 to 9·6 per cent., and the electricity from 7·2 to 7·7 per cent. These figures are a welcome proof of the good business which is being done in the gas trade."

COST OF DOMESTIC HEATING.

Some "Times" Correspondence.

The concluding lecture of the series on "Methods of Economizing Heat," delivered by Mr. C. R. Darling at the Royal Society of Arts last month, in which the lecturer dealt with the cost of domestic heating, has given rise to correspondence in "The Times," some portions of which it may be of interest to notice.

The first letter was by Mr. Hylton B. Dale, who disagreed with the ratio of expense of various forms of heating given at the end of the lecture; but as no particulars of how they were arrived at were furnished, he was unable to criticize them in detail. But taking a 12-hour day as the usual period of consumption, a modern economic stove would, Mr. Dale said, burn about one-third less fuel than the wasteful grates of the Victorian era; the total consumption per day in the former being (say) 20 lbs. and in the latter 30 lbs. An anthracite stove usually consumes about 12 lbs. in the same period. The writer continued as follows: "The gas companies state the average consumption by their stoves is 31 cubic feet per hour, and presumably they do not underrate the quantity. If we assume the following costs—viz., bright house coal, 27s. per ton; anthracite nuts, 42s. per ton; gas, 2s. 6d. per 1000 cubic feet—we get the following expense per 12-hour day: Coal in modern stoves, 2⅝d.; coal in Victorian stoves, 4⅜d.; anthracite, 2⅜d.; and gas 11d. Thus it will be observed the gas-fire costs nowadays four times that of a coal-fire or an anthracite stove."

This letter was followed by one from Mr. J. D. Hamilton Dickson, of Peterhouse, Cambridge, in the course of which he made the following remarks.

Mr. C. R. Darling, in his recent Cantor Lectures at the Royal Society of Arts, gives an estimate of the costs of various means of domestic heating. He takes coal at 26s. per ton, anthracite at 36s. per ton, gas at 2s. 6d. per 1000 cubic feet, and electricity at 1d. per unit. Hence, he gives the relative costs as: Open coal-fire, 1; closed anthracite stove, 0·39; open gas-fire, 1·54; and electric radiator, 6·5 (another report of these ratios is 1, 0·5, 1·5, 6). No mention is made of the efficiency of the heating; but as the estimate appears to be theoretical, we may take it that the heating is presumed to be sufficient.

In the winter of 1910-11, I made a continued series of observations on the cost and efficiency of the heating in my own house; employing an open coal-fire, a closed anthracite stove, an open gas-fire, and an electric radiator. In these results, the price of coal was 23s. 6d. per ton, anthracite 39s. per ton, gas 2s. 8d. per 1000 cubic feet, and electricity 1d. per unit. The actual costs for a week of seven days of 12 hours each, as shown by my coal bill and by the readings on the gas and electricity meters were: Open coal-fire, 49d.; closed anthracite stove, 14d.; open gas-fire, 141d.; electric radiator, 168d.—giving the ratios (corresponding to Mr. Darling's) of 1, 0·29, 2·88, 3·43. The open grate was a slow-combustion stove; and the temperature observations were made on three thermometers—one outside the house, one in the room about 8 feet from the fireplace, and the third in the neighbourhood of the fireplace. With the anthracite stove, the room was kept continuously at or above 60° Fahr., generally with the window open, even in the coldest weather. The present mild winter has brought forward prominently the economy of anthracite. The stove in question has been burning continuously night and day from Sept. 28 till now [Dec. 30.] Between that date and Dec. 28 it consumed 10 cwt. of anthracite at 40s. per ton. Thus the cost per week of seven days of 24 hours each has been only 18·46d., or about two-thirds of the cost in the previous series of observations (27·30d.). The temperature of the room has been maintained at or above 60° Fahr., and on one occasion the outside temperature fell to 26° Fahr. The stove is rated to heat 2500 cubic feet; the room measures about 2600 cubic feet.*

Referring to Mr. Dale's numbers, I am unable to check them all; but the data I have given for anthracite shows a daily (24 hours) consumption of 12·31 lbs. Two slow-combustion coal-fires consumed together 5 tons of coal (at 25s. 6d. per ton) from Aug. 8 to Dec. 7, 1912; giving for one fire 46·28 lbs. of coal daily (12 hours), for a room of 2300 cubic feet, maintained at or over 60° Fahr. With regard to gas, my experience differs entirely from Mr. Dale's presumption. As a fact, the consumption of gas was 52½ cubic feet per hour; my skilled adviser having told me that 25 cubic feet per hour would suffice to keep the room comfortable. I note specially that all these costs are the actual amounts as shown in my coal, gas, and anthracite bills for the periods in question.

In the Engineering Supplement to "The Times," last Wednesday, Mr. Darling replied as follows to the remarks of the two correspondents named.

Both of these gentlemen take exception to the figures for relative costs which appeared, without explanation, in the report of my lecture; and I wish to explain the manner in which the values given were arrived at. Taking an ordinary coal fireplace, it was assumed that only 20 per cent. of the heat of the fuel was utilized in warming the room; and it was then computed, from the average calorific value of household coal, selling in London at 26s. per ton, that 112,000 B.Th.U. were produced by burning one pennyworth. Twenty per cent. of this quantity of heat, or 22,400 B.Th.U., would therefore represent the effective warming power of one pennyworth of coal. In the case of gas-fires and anthracite stoves, an efficiency of 75 per cent.—which may be realized in practice with either—was assumed; and by taking cost and calorific value into account, as before, the figures given resulted. All this was fully explained in the lecture, and will appear in the full account to be published in the "Journal of the Royal Society of Arts."

This method of calculating comparative costs refers only to the best conditions of working, and does not pretend to take into account the relative importance of direct radiation and convection. It was adopted because the figures given by different authorities for the relative costs of the methods varied so greatly that no concordant values could be derived from them. No better example of such disagreement could be given than the data put forward by your correspondents; and it is evident that the tests must have been made under widely different conditions. The matter is of such general interest and importance, that I am suggesting to the Royal Society of Arts the appointment of a disinterested Committeee to investigate the whole question.

In the course of a reply to Mr. Hamilton Dixon, Mr. Dale offered the following observations on the subject of heating by gas.

Mr. Dixon says he cannot agree with my figures for gas; and he gives his own experience as 52½ cubic feet per hour, against the figure of about 31 cubic feet per hour which I mentioned. But this figure is that given by the gas companies as the result of their special tests. My own experience gives 42½ cubic feet per hour as the general average consumption, which is about midway between the two figures quoted, and is therefore likely to be pretty correct. Apart from the ventilating difficulty, a further point is that the gas companies seem unable to provide a stove which will radiate heat to any distance—the heat remaining always purely local.

The last letter in the group contained in the Engineering Supplement last Wednesday was by Mr. F. W. Goodenough, who wrote as follows:

Both Mr. Hylton Dale and Mr. Hamilton Dickson, in their comparisons of the costs of gas and coal for heating, ignore one very

* Details of the results of these trials were given in the "JOURNAL" for March 14, 1911 (p. 790).

important factor—viz., that the heating of rooms in this climate rarely needs to be continuous, even in the case of living-rooms, and never in the case of bedrooms (except when they are sick-rooms), studies, bath-rooms, billiard-rooms, dining-rooms, and other rooms used only spasmodically.

Any comparison between the costs of heating by gas and electricity on the one hand and coal on the other, which is simply based upon the respective costs per hour when burning, is quite misleading if what is desired is to decide which is more economical for practical use, year in and year out. Misleading also is any such comparison which ignores the saving of labour effected in the household when coal is done away with, or the advantages in the sick-room of a system of heating which can be relied upon to maintain the warmth of the patient without the need (or noise) of frequent replenishing, or the grave danger sometimes attending the dying-out of the fire.

In the case of a bed-room where a fire is only wanted in cold weather for half-an-hour in the morning, an hour for dressing before dinner, and half-an-hour at night, the cost of a gas-fire would only be, on Mr. Mr. Dale's figures. less than 2d. per day. This is one-third less than the cost of keeping a coal-fire in all day, to say nothing of the work entailed in attending to it, laying it, cleaning the grate, carrying coals, &c., and the likelihood of its being out just when wanted.

The hourly consumption by a modern gas-fire capable of heating a room of 2600 cubic feet capacity would not exceed 30 cubic feet when full on, and ought not to average more than 25 cubic feet per hour; and Mr. Hamilton Dickson must make another experiment if he wishes to have data which he can quote with the certainty of accurately representing the position to-day. His delight in anthracite-stove heating will not be shared by many of his countrymen, who have a sound preference for an open radiant fire which actively aids ventilation, and avoids the radical hygienic error of heating the air of (instead of the objects in) a room. Most of us prefer to reproduce in our rooms the effect of sunshine and fresh air by using a glowing radiant fire which ventilates, rather than the stuffy atmosphere of a railway carriage or a Continental hotel.

This is why (fortunately for the atmosphere of our cities, which have been delightfully free from murky fog this winter) the modern open gas-fire, with its efficient flue for removing products of combustion, preventing smell, and assisting ventilation, is so rapidly displacing the coal-fire and closed stove in our homes.

BRITISH COMMERCIAL GAS ASSOCIATION.

Extracts from the Last Report of the Executive Committee.

As mentioned in the "JOURNAL" last week, the current number of the "Bulletin" of the above-named Association contains the essential items in the report presented by the Executive Committee to the General Committee on the 3rd ult. The following are among them.

THE MANCHESTER CONFERENCE.

The total cost of the first annual general meeting and conference was £450. This includes the remuneration of the extra staff employed to assist the Chairman and Secretary in carrying out the work of organization. In addition, an expenditnre of £250 has been incurred in the printing of the report of the proceedings, against which there will be a substantial credit for sales. Up to the present, 376 copies have been purchased; and it is hoped that many more will be bought by members for circulation to directors and councillors as evidence of the important work that is being accomplished, and the view that is taken of that work by leaders in the industry and also by the Press and public at large.

The expenditure on the conference was doubly justified. In the first place, the proceedings secured publicity in the daily and weekly Press to a very gratifying extent. The space devoted to reports of the proceedings (including many excellent reports of the lecture by Professor Lewes), if purchased at advertisement rates, would have cost at least £2000; while such an article as the leader in the "Manchester Guardian" could not be bought, and its value is not easy to estimate. In the second place, the effect upon the administrators of gas undertakings throughout the country, subscribers and non-subscribers alike, has already far more than paid for the conference, and bids fair to make good its cost ten times over.

The Committee will have read with pleasure the note upon the conference which the President wrote for publication in the "Bulletin" for November; and this expression of satisfaction is finding an echo throughout the country.

INCREASED SUPPORT FROM EXISTING SUBSCRIBERS.

Since the conference, applications for the payment of subscriptions for the current year have been issued, and letters asking undertakings which have not previously subscribed on the full basis to reconsider the question were sent for presentation with those applications. The results, so far, have been that the Glasgow and Oldham Gas Committees have recommended payment of subscriptions at the full rate, which will increase their contributions from £525 and £73 to £900 and £182 respectively; that Dublin have voted the full rate, increasing their contribution from £100 to £208; that the Birmingham Corporation have increased their contribution from £250 to £500; and Southampton from £25 to £50.

There can be no question that the conference also served to inspire with increased confidence and satisfaction many directors and councillors who had previously subscribed to the Association on the faith of an assurance from their officers that it was a movement worthy of support. This is evident from much of the correspondence that has reached the office, as well as from verbal opinions which were expressed, publicly and privately, at Manchester.

ADDITIONAL SUBSCRIBERS.

Another most satisfactory result of the conference is the steady inflow of additional subscriptions. Since the last meeting of the General Committee, the following twenty undertakings have been added to the list of subscribers: Bilston, Bo'ness, Bridgend, Brighouse, Broughty Ferry, Buckfastleigh, Chelmsford, Chichester, Claycross, Cleethorpes, Cromer, Darlington, Folkestone, Fowey, Maidenhead, Mossley, Oxford, Polmont, Smethwick, and Widnes. Encouraging reports as to efforts made to secure the undertakings as subscribers have been received from Devonport, Edinburgh, Leicester, Nottingham, and Rochdale, as well as from many smaller towns.

CANVASS OF NON-SUBSCRIBERS.

Active steps are being taken to secure further subscribers. So far, letters have been sent to every non-subscribing undertaking with a make of 20 millions and upwards; and before long every undertaking of 10 millions and upwards will have been canvassed. To assist in this work, a pamphlet setting forth "Some Reasons Why" it pays every undertaking to subscribe has been prepared, copies of which have been sent to the Committee. It is suggested that every member might with advantage purchase a supply of this pamphlet to enable him to furnish a copy to each of his directors or councillors when the subject of the Association is under discussion, or to send copies to others whom he is trying to interest in the work.

CO-OPERATION OF DISTICT ORGANIZATIONS.

The co-operation of the various discrict organizations has been invoked in aid of this canvass, and valuable help is promised already in this direction. In this connection, it is suggested that good service would be rendered to the Association if district meetings of members and supporters of the Association were organized by the District Institutions and Associations; if one of the Vice-Presidents for the district were asked to preside; and if the managers and administrators of non-subscribing undertakings were invited to be persent. An address by one of the members of the General Committee representing the district, giving information as to the work that is being accomplished, and inviting those present to offer suggestions for consideration by the Committee, and to give their views upon the value of the Association's campaign, would do much to stimulate interest throughout the country and secure additional support.

The Executive, upon careful consideration, feel that it would be a mistake to hold more than one general conference of the Association annually, and are of opinion that the scheme above outlined would be of greater value than any intermediate general conferences.

PRODUCTION AND SALE OF LITERATURE.

The list of booklets, pamphlets, postcards, showcards, posters, and other advertising matter grows steadily. Recent valuable additions to the list include reprints of the lecture delivered by Professor Lewes and the paper read by Mr. Creasey at Manchester, for both of which there was demand from several quarters.

With a view to enabling managers who are desirous of supporting the Association and securing its services, but have not yet been able to persuade their undertaking to subscribe, to avail themselves of the Association's literature, and at the same time contribute indirectly to its funds, the Executive have agreed, in a limited number of cases and for a limited period, to supply such managers with literature at list price *plus* 33⅓ per cent., which means that they are paying prices higher by 66⅔ than those paid by subscribers at full basis rates.

Orders for a million of the Association's publications (or nearly twice the figure reported on the 12th of September) have now been received and dealt with; while blocks for use in local publicity work are being supplied in steadily increasing numbers.

LEGAL POSITION OF DISTRICT COUNCILS.

The Executive having been asked for advice by the officers of several District Councils as to their powers to subscribe to the funds of the Association, and the risk of surcharge by the Local Government Board Auditor, have had the subject under consideration; and the position, as far as the Committee have been able to ascertain it, is that subscriptions by local authorities to the Association cannot be made "lawfully," but such items are not necessarily disallowed. They may receive the sanction of the Local Government Board under the Local Authorities Expenditure Act, 1887; and an appeal to the Board against a hostile decision of the District Auditor would probably be successful. This opinion (which is based upon good authority) is sufficiently good ground for advising local undertakings that they are very unlikely to be surcharged with a subscription to the Association, or that such surcharge would be enforced by the Local Government Board upon an appeal being made to that body. Furthermore, the Association would, as a final resort, if a local authority had a surcharge enforced upon it, refund the amount of the subscription rather than allow the individual members of a District Council to suffer loss.

The Executive Committee do not feel that the time is ripe for officially approaching the Local Government Board on the subject. The longer the Association has been established, and the more clearly the value of its work is felt and recognized by its supporters, the stronger would be their case in arguing before the Board if the necessity arose; and they feel that it would be better to promise support to local undertakings if the difficulty should become crucial, than to take action now, when they feel that it would be premature.

Price of Gas at Batley.—A letter has been received by the Batley Town Council from the President of the Local Government Board as a result of protest meetings held in the Soothill Ward of the borough. The resolutions passed at these meetings resented the increase in the price of gas—giving as reasons that Soothill should not be made to contribute, through the higher charges for gas, towards any deficit in the rates; that the agreement to lower the price of gas had never been carried out; and that at the inquiry in regard to the Batley Extension Order it was stated that the borough had "a large credit balance on the revenue account." The resolutions were sent to the President of the Board; and Mr. Burns, in forwarding copies to the Batley Corporation, intimated that he took a serious view of the matter, and might find it necessary to bring the case to the notice of Parliament. Before doing so, however, he asked for the observations of the Council; and a Sub-Committee has been appointed to confer with the Town Clerk in the preparation of a reply.

METROPOLITAN WATER BOARD.

The Board's Deficiency.

It may be remembered that the Metropolitan Water Board decided to promote a Bill to obtain power to liquidate the deficiency, amounting to about £210,000, resulting from their control of the water supply of the Metropolis. This proposal was, however, subsequently defeated; and the Board thereupon decided to issue precepts upon the authorities constituting the Board. The advice of the Auditor of the Local Government Board was sought, and he has intimated that, in his opinion, the Board ought to have raised the amount of the deficiency year by year as it arose, and not have allowed it to accumulate. Consequently, if any district feels aggrieved on the receipt of the precept, and appeals against the payment, the Auditor will have no option but to declare that any levy beyond that required to meet the deficiency for the current year is illegal, and the members of the Board will be liable to be surcharged the amount improperly levied. It is stated that Counsel who have been consulted by the Board on the subject uphold the view of the Auditor.

The subject of the Board's deficiency came before the House of Commons last Tuesday in a question put to the President of the Local Government Board by Mr. Carr-Gomm. The honourable member wished to know whether the Local Government Board Auditor had been consulted by the Water Board with reference to the existing deficit in their finances; whether he was aware that this deficit amounted to £210,000; and whether he could state what was the opinion of his Auditor as to the policy of the Board in the matter, and the proposals made to meet the present state of affairs. Mr. Burns, in reply, said it was not part of the functions of the District Auditor to advise the Water Board on questions of policy. He was informed by the District Auditor that he had not been formally consulted by the Board with reference to the matter alluded to, but that it had been the subject of discussion between himself and officers and members of the Board. The Auditor, in the course of reports to the Board on his audit, had drawn attention to the increasing deficiency and the failure to issue precepts to the rating authorities or to take other steps to remove it. He (Mr. Burns) was informed that the revenue deficiency amounted to nearly £210,000 at the end of the last financial year, and that the Board had decided to issue precepts for the deficiency to the local authorities liable to contribute the amount.

The Opening of the Chingford Reservoir by the King.

It has already been mentioned in the "JOURNAL" that the new reservoir of the Metropolitan Water Board at Chingford will be opened this year by the King; and at the meeting of the Board last Friday, a sum of £4000 was voted in connection with the ceremony, the date of which has not yet been fixed. At the request of His Majesty's Private Secretary (Lord Stamfordham), the Works and Stores Committee prepared and submitted for the King's consideration a draft of the programme which might be deemed suitable for the occasion. It assumes that the King will proceed to and from the reservoir by road; and the Committee have suggested that the ceremony should take place at the northern end of the reservoir, where the power-house and pumps are situated, and where the turning of the water into the reservoirs could be most conveniently performed. The Committee propose that 1500 invitations should be issued to members of the Board, constituent authorities, representatives of public bodies and institutions, and to distinguished persons whose presence would be welcome to the Board on such an occasion. The £4000 mentioned includes the provision of the necessary stands, shelter marquees, police, and other indispensable adjuncts. It, however, makes no provision for refreshments; the Chairman of the Board (Mr. E. B. Barnard, J.P.) having expressed a strong desire to undertake himself this part of the arrangements. Provision has been made for the presentation of an address, which it is hoped His Majesty will graciously consent to receive. A Special Sub-Committee has been appointed to proceed with the details of the arrangements and to act as a Reception Committee at the ceremony.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

With reference to the note in the article in "Gas Affairs in Scotland" in the last issue of the "JOURNAL," it has been pointed out that the post to which Mr. R. Halkett was appointed in Glasgow is that of "Commercial Superintendent" for the "Distribution Department."

Members of Junior Associations should remember that they have something beside their own interests and pleasures to consider in regard to the visits that they ask, through the officials of their Association, to be allowed to make, and that is to avail themselves of the kind permission granted to them. The wretched turn-out of the Eastern Juniors to the Bedlay Colliery Coke-Ovens was most discourteous to their hosts, who had asked several of their officials to forego their Saturday holiday to pilot the Juniors round the works and describe the various processes carried out. Such a small number turned up that only one cicerone was required, and the others had wasted their holiday uselessly. Messrs. William Baird and Co., Limited, had also provided a long table and seating accommodation in the sulphate-packing room, with an ample supply of provisions for a large party. On account of the small numbers who availed themselves of their hospitality, it will probably be a long time before they will again accede to any request for permission to view their works. This is the more to be regretted because the Semet-Solvay ovens and processes follow more closely the ordinary gas-works routine than some other coke-producing plants, and are therefore more interesting and instructive to the gas manager. A thing which struck one was the clear dividing-line down the middle of the coke as it was pushed out, showing where the carbonization from each side had met. The gas, no doubt, issues up the sides of the retort, as the wall of coal being dealt with is at first a slight distance from the sides. The retorts have horizontal heating chambers and burners, with a warmed air supply from the waste gases before they pass to the boilers to heat them on the way to the chimney. These boilers, when there is any extra steam above a pre-arranged pressure, allow the balance to pass to the aid of the boilers supplying the steam for the colliery plant. The charges of coal are compressed by drop hammers, which punn the coal into the charging-trough as it is slowly filled, so that it is thoroughly compressed throughout. About 10 per cent. of water is contained in the mass, which weighs about 7 tons. Other points of note were the very even heats throughout the retorts; the simple, but powerful, machinery which has to push in the 7 tons of coal and push out some 4 tons of coke; the small amount of manual labour required; and the importance of looking after all the residuals, such as the sulphate of ammonia, the tar derivatives, and the benzol.

Edinburgh.—The Town Clerk of Edinburgh has been instructed to prepare a report on the question of the Corporation promoting a Provisional Order to enable them to supply electric light to all suburban districts requiring it. This has been done owing to requests having been received from suburban districts for a supply of electric light.

Glasgow.—Mr. Peter Fyfe, the Chief Sanitary Inspector of Glasgow, gave a lecture, under the auspices of the Glasgow and West of Scotland branch of the Smoke Abatement League, upon means of "Air Purification," and he pointed out that constant complaints were made that no means of dispensing with coal with economic advantage had been offered to the poorer classes, who formed 62 per cent. of the population of Glasgow. Gas, charcoal, petroleum, and electricity were all too dear for such consumers, and coke was too dirty for the heating power obtained from it. He suggested that gas might be put on the rates, and stated that he thought £2,500,000 would be better spent in cleansing the atmosphere than in cleansing the Clyde. The only thing to do was to pray for the time when coal got dearer and gas or electric energy got cheaper. If gas were supplied at 1s. 6d. per 1000 cubic feet, as it is in Sheffield, Coatbridge, and Hamilton, and coal at 1s. per hundredweight, every citizen might be persuaded to burn gas and obtain its heat more economically, while conferring an incalculable blessing on the population of the city. It is interesting to remember that Mr. Fyfe is the inventor of a gas-fire known as the "St. Mungo," which caused considerable interest at both the Glasgow and Edinburgh Gas Exhibitions.

Alloa.—A new gasholder of a capacity equal to about 300,000 cubic feet has just been erected and brought into use at the Corporation gas-works at Alloa. The new holder is 80 feet in diameter, and is composed of three separate lifts, which, when they are fully inflated, rise to a height of about 70 feet from the ground. The cost of the structure is some £4000. The holder was erected by Messrs. Henry Balfour and Co., of Leven. An interesting feature of the operations just completed is the fact that, in order to provide a site for the new erection, an old gasholder was dismantled, and the brick and puddle tank (which was originally constructed as far back as 1862) was deepened by the erection of a ferro-concrete wall 6 feet high round its rim. The erection of the holder marks another stage in the development of this most successful department of the Alloa Corporation's undertakings. The last new gasholder was built in 1892, when the manufacture of gas for the year was only 40 million cubic feet, as compared with an output for the past year of about 150 millions. From this it will be seen that extra storage of gas was urgently required. The new holder has doubled the storage capacity of the works, which now amounts to 640,000 cubic feet—this being practically equal to one day's output of gas at the time of maximum consumption. The work of erecting the new holder was done under the supervision of Mr. J. W. Napier, the Gas and Electricity Engineer to the Corporation.

Berwick.—A definite completion of a matter which has been troubling the good folk of Berwick for over 25 years was reached on Wednesday, when Councillor Cowe cut the first sod in connection with the new borehole on the site at Tweedmouth which had been previously pegged out. Previous to the commencement of the borehole proper, which will be carried to a depth of 300 feet, a well 26 feet deep has to be dug. About 10½ miles of piping will be used; and the estimated cost of the scheme, which has been prepared by Messrs. Reid and Ware, of London, is £21,870.

Doune.—On Tuesday, the gas-works ceased to be the property of the Doune Lighting Company, and passed into the hands of the Town Council. Many improvements in the supply will be looked for.

Inverness.—At the Town Council meeting held on Monday night, Provost Birnie presiding, Mr. Petrie moved the adoption of the report of the Gas-Works Committee. The deficiency in the Gas Department last year was £489. This was accounted for, to a great extent, by the loss on the gas supplied by prepayment meters, which amounted to £334. It was agreed to revert to the price formerly charged for gas supplied through prepayment meters—namely, 5d. per 1000 cubic feet more than when supplied through ordinary meters. An inquiry was held in Inverness regarding a proposal for a Provisional Order prepared by the Corporation for additional borrowing powers for certain extensions at the gas-works, laying new water-mains, and other purposes. Sheriff Mackenzie, who held the inquiry, has delayed giving his decision.

Langholm.—The Town Council are to lay the whole of the new water-mains before connecting up to the consumers' premises, so as to ensure a pure supply. The Engineers, Messrs. Taylor and Wallen, of Newcastle, report a scarcity of navvies, which is impeding the progress of the work.

Linlithgow.—The Town Council have applied to the East Stirlingshire County Council for a supplementary supply of water from their system. The Water Superintendent of the latter body has reported that the new 6-inch pipe from Slamannan to Babbithill was unable to supply sufficient water to that district, and suggested a new 6-inch main into Avonbridge, at a cost of £1080. A report is to be obtained from the Engineer; and the Water Committee were given powers to proceed thereon.

Perth.—Another serious breakdown has occurred in the Perth gas plant, which is causing great inconvenience in the town. It is really

most unfortunate that all their troubles seem to come together. This time it is the new mechanical stoking-machine. Owing to the breakdown, the stock of gas was reduced to such an extent that the undertaking is being worked practically from hand to mouth. The makers, who have the plant still under guarantee, sent a representative on Thursday; and he is working with the object of completing the repair at the earliest possible moment.

Peterhead.—The new Council have a majority in favour of further investigation into the gas affairs of the burgh. There has been an increase of gas for the twelve months ending Dec. 15 of 503,300 cubic feet over that of the same period last year. The sales of coke and other residuals have increased by over £40; while the total sales for the half year have increased by £320. The Council have, therefore, retained the services of Mr. R. C. Millar, of Edinburgh, to examine the books, &c., and investigate the management of the Gas Department, and have arranged for him to employ such expert assistance as he may desire.

Wick.—At a meeting of the Wick Chamber of Commerce on Wednesday, ex-Convener Nicolson referred to an agitation at the time when the gas was 12s. 6d. per 1000 cubic feet in the town, which resulted in an increased consumption following on the reduced rate. He considered the Wick Gas Company should be able to supply gas quite as reasonably as any other of the east coast towns, and that a reduction to the lowest price charged in such places should obtain in Wick. It was ultimately agreed to open negotiations with the Gas Company and also with an electric light company.

Publicity.—No gas manager now questions the need for advertising his commodity. If he has any doubt whatever in this connection, it is probably in regard to the form his advertisement shall take. That there are almost endless varieties of leaflets, cards, &c., setting forth the advantages of gas is evidenced by a collection we have received from the Caxton Press, Limited, of Furnival Street, E.C. Included in the parcel are two coloured broadsides (one 5 ft. by 3 ft. 4 in., and the other 3 ft. 4 in. by 2 ft. 4 in.), both of which are reproduced on a small scale as leaflets or cards.

Water-Main Obstructions in Cork.—At a recent meeting of the Cork Corporation Water Committee, Mr. Tilson mentioned the analysis of the water supply, and suggested that the City Engineer should make a map showing the whole line of water-pipes, with the old and new in different colours, so as to enable the Committee to see whether or not they would be obliged to deal with the financial side of the question. The City Engineer said he had reported two years ago on the condition of the mains, and the corrosion that had set in. He could not say how many miles of pipes would require renewal, and how many would stand cleaning; but he thought they ought to change one or two pipes each year. The Engineer was instructed to prepare a report as to renewal. A section of pipe taken up was laid before the meeting, and the bore was seen to be almost choked with some concrete material.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Jan.* 11.

Sulphate of Ammonia.

Although the volume of new trade direct from buyers abroad has not been large, the tone of the market has continued strong throughout the week, dealers having apparently considerable quantities to purchase in order to fulfil their obligations. Home consumers have shown more interest, but they do not willingly pay the prices required by sellers. At the close, the values are £14 6s. 3d. to £14 7s. 6d. per ton f.o.b. Hull, £14 8s. 9d. to £14 10s. per ton f.o.b. Liverpool, and £14 10s. to £14 11s. 3d. per ton f.o.b. Leith. There has been some inquiry for future delivery, but the ideas of manufacturers have been too divergent from those of buyers to admit of much first-hand business.

Nitrate of Soda.

There is a firmer feeling in this market again, and the spot quotations have been advanced to 11s. 7½d. per cwt. for ordinary and 11s. 9d. for refined quality.

LONDON, *Jan.* 13.

Tar Products.

There is not much alteration in the markets for tar products. Business is still on the quiet side, though prices remain tolerably steady. Pitch is fairly firm; but there is not a great amount of inquiry. Intending purchasers do not yet feel inclined to pay the increased values. On the other hand, makers are fairly firm. Benzols are quiet; and there is very little fresh business doing. Solvent naphtha does not appear to be quite so firm; and there is more stuff offering. Heavy naphthas are fairly steady. Consumers report that they are being offered fair quantities of crude carbolic at slightly below to-day's quotations. On the other hand, makers will not sell to-day under present values. Creosote is very firm; and the inquiry is quite good.

The average values during the week were: Tar, 28s. 9d. to 32s. 9d. Pitch, London, 45s. 6d. to 46s. 6d.; east coast, 45s. 6d. to 46s.; west coast, Clyde, 45s. 6d. to 46s.; Manchester, 43s. 6d. to 44s. 6d.; Liverpool, 44s. 6d. to 45s. 6d. Benzol, 90 per cent., naked, London, 10½d. to 11d.; North, 9½d. to 10d.; 50-90 per cent., naked, London, 10½d. to 11d.; North, 10d. to 10½d. Toluol, naked, London, 10½d. to 11d.; North, 10d. to 10½d. Crude naphtha, in bulk, London, 5½d. to 5¾d.; North, 5d. to 5½d. Solvent naphtha, naked, London, 1s. 1d. to 1s. 1½d.; North, 1s. 1d. f.o.b. Heavy naphtha, naked, London, 11½d. to 1s. f.o.b.; North, 10½d. to 11d. f.o.b. Creosote, in bulk, London, 3⅝d. to 3¾d.; North, 3⅝d. to 3¾d. Heavy oils, in bulk, 3⅜d. to 3½d. Carbolic acid, casks included, 60 per cent., prompt, east and west coasts, 2s. 1d. to 2s. 2d. Naphthalene, £5 to £9; salts, 45s. to 50s., bags included. Anthracene, "A" quality, 1½d. to 1¾d. per unit, packages included and delivered.

Sulphate of Ammonia.

The market is steady; but there has not been a large number of fresh orders in the market during the past week. Outside London

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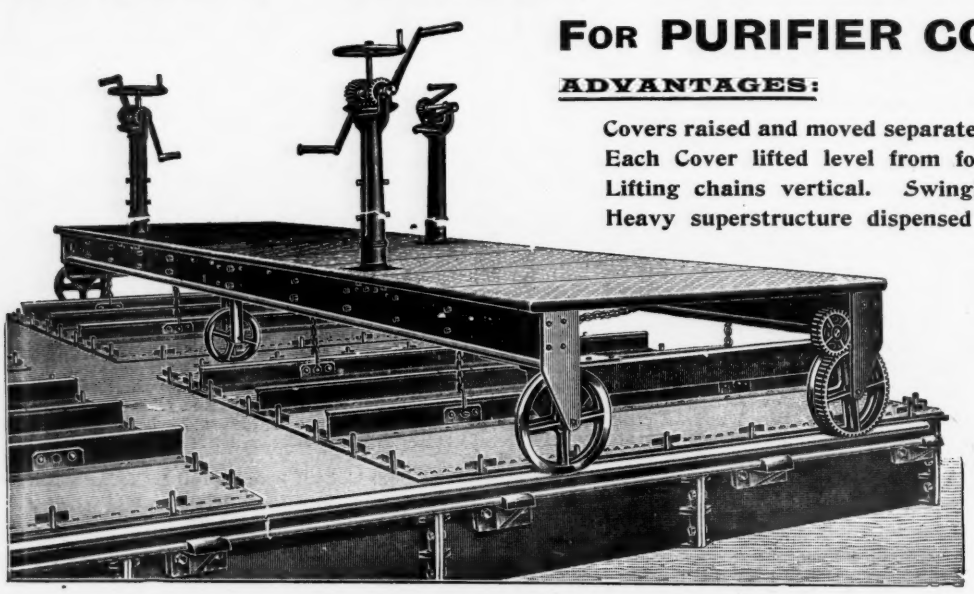

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makes are quoted at £13 12s. 6d.; Leith, £14 10s.; Liverpool, £14 10s.; Hull, £14 8s. 9d.; Middlesbrough, £14 8s. 9d. A premium of 2s. 6d. to 5s. per ton is asked for forward delivery.

COAL TRADE REPORTS.

Northern Coal Trade.

The coal trade is now brisker, as the production is nearer normal; and with steamers plentiful at the coal ports, there is a full shipment. In steam coals, best Northumbrians are from 15s. to 15s. 3d. per ton f.o.b.; and second-class steams are about 14s. 3d. Steam smalls are scarce, and are from 11s. to 11s. 9d. per ton f.o.b. The home demand is fair; and the exports are about an average for this season of the year. The gas coal trade is very active; and the prices are generally firm, though the contracts at lower values than those now current take up most of the production. Best Durham gas coals are about 16s. per ton f.o.b., and second-class gas coals are from 15s. For "Wear specials," up to 16s. 6d. per ton is the f.o.b. quotation. These are very high prices for even Durham coals at the period of the fullest demand; but some of the long contracts are running at figures fully 2s. 6d. per ton below those quoted, as the advance in prices in 1912 was largely in the later months of the year. The tenders for the contracts for gas coal for Copenhagen have now been sent in; but the details are not yet made known, though a much higher price is expected than that of twelve months ago, which was 2s. above the price of the preceding contracts. Coke is firm. Gas coke is in full supply—good makes being about 21s. 6d. per ton f.o.b. in the Tyne.

Scotch Coal Trade.

Throughout Scotland a very good beginning has been made in the coal trade. There is no lack of orders; and the demand for all classes of fuel is on a high level. On Friday, the approximate prices quoted on the Glasgow Coal Exchange were as follows: Steam coal, 13s. 6d. to 14s. per ton f.o.b. Glasgow; splint, 14s. to 14s. 6d.; ell, 13s. to 13s. 6d.; trebles, 13s. 6d. to 14s.; doubles, 13s. to 13s. 6d.; and singles, 12s. 6d. to 13s.

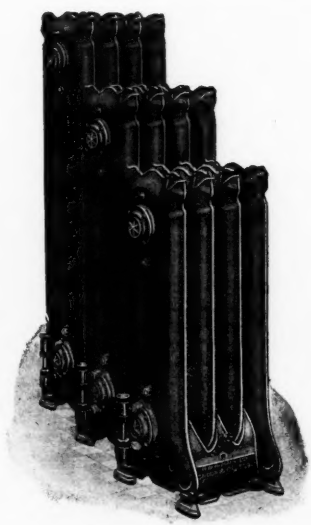
Peat Industry in Russia.—According to a United States consular report, the very high price of oil in Moscow has forced consumers to use every effort to find a substitute or to limit consumption. The Sormovo works, which had increased their consumption of liquid fuel from 2,000,000 to 3,176,000 poods per annum, have again limited the use of it to 2,000,000 poods, and at the same time are developing the production of peat, buying wood, &c. They are said to have purchased about 250,000 acres of Government land, on which they will produce peat and construct gas-works and an electricity station. The Moscow Electric Light Company, who consumed 2,500,000 poods of oil in 1911, have purchased an extensive area of peat swamps, and are starting the production of peat with improved machinery.

Fatal Fall Inside a Gasholder.—The Manchester Coroner, Mr. E. A. Gibson, held an inquest last Wednesday on Walter Ashurst, aged 32, a labourer, who was employed in the construction of a gasholder for the Manchester Corporation. On the previous Monday, Ashurst was in the holder with another man removing the planks of a scaffold when he fell—his head striking the concrete floor 14 feet below—and was killed. The foreman of the job said there was nothing particularly dangerous about the work; and Ashurst had done the same kind of thing before. A verdict of "Accidental death" was returned.

Condition of the Malvern Gas-Works.—At last Tuesday's meeting of the Malvern Urban District Council, Sir Henry Grey, who presided, stated that Sir Corbet Woodall inspected the gas-works on the 14th ult., and expressed himself highly pleased with everything he saw; saying that for an undertaking of its kind it was the best he had seen, and in excellent order. Sir Henry explained that the Council's difficulties in connection with the gas arose from want of pressure, due to the obsolete character of the mains. Whereas now nothing less than 4-inch mains were used, many of those in the urban district were only 3 inches, and some only 2 inches. Sir Corbet Woodall said that to put up a new gasholder, as had been suggested, would undoubtedly solve their difficulties; but it would be a costly solution, and he should not recommend it.

Rival Water Schemes.—An inquiry has recently been held at Topsham, by Mr. W. O. E. Meade-King, M.Inst.C.E., respecting an application by the St. Thomas Rural District Council for the Local Government Board's sanction to a loan of £500 for experimental works with a view to the provision of a supply of water to the town. It was stated that the water question had been under consideration for ten or twelve years, but that nothing had been done because of the opposition of the Parish Council. There were about 300 wells, and all of these which had been examined had been found unsatisfactory. Last January, the Parish Council put forward a scheme, which, however, was condemned by the experts to whom it was submitted. The District Council now proposed to bore for water, and, if successful, to carry out the necessary works. Some houses in the Topsham area are supplied from the Exeter mains; and the City Corporation have applied for an Order to annex this part of the district. Other houses are supplied by the Topsham Water Company, who have made a borehole and constructed works, but are hampered by the fact that they have no power to open the roads. The District Council objected to the Water Company's supply on the ground that there is the risk of its contamination by the percolation of sea water. Mr. W. Whitaker, F.R.S., Mr. A. P. I. Cotterell, M.Inst.C.E., and Mr. S. R. Lowcock, M.Inst.C.E., gave evidence in support of the District Council's scheme; and Mr. C. Carus-Wilson, F.R.G.S., supported the scheme of the Water Company. The Parish Council asked that the Local Board's sanction should be postponed, pending the results of an application by the Council for urban powers, which, if granted, would enable them to deal with the water question.

By Test the Best.



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They are made on the soundest mechanical lines with metal to metal joints (no rubber or red lead used).

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And last, but not least, they are fitted with our patent, automatic regulating valve—the most efficient and positive device of its kind. It reduces the gas consumption immediately the temperature rises. Ensures economy and prevents the waste of gas, which is inevitable with a valveless radiator.

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Bye-Products in the Past Year.

In an article dealing with this subject in the "Iron and Coal Trades Review" last Friday, the following were mentioned as the noteworthy features of the year: "The extension of direct and semi-direct processes for the recovery of ammonia and tar continues to progress, and the experience of dealers clearly shows that, where reasonable care is exercised, the salt produced possesses no deleterious properties, and is taken by consumers as equal in quality to that produced by the older process. As an adjunct to the bye-product apparatus, the chamber system for the production of sulphuric acid for neutralizing the ammonia has made its appearance at coke-works. . . . The distillation of coal tar presents a profitable field for exploitation in connection with all plants producing from 6000 tons upwards annually; and this promises further extension (there are already a number of plants in operation) during the year. The degree to which the crude tar should be advanced depends upon the available quantity and the market. So far as the production of lighting gas at coke-ovens and its eventual sale to the distributors is concerned, little progress can be recorded in this country, despite its increasing employment in Germany. There can be no question as to the ability of works to give a continued supply of a predetermined quality; and even the question of peak demands has been already satisfactorily solved."

Reduction in Price at Aberystwyth.—The Directors of the Aberystwyth Gas Company at their last meeting resolved to reduce the price of gas from 3s. 4d. to 3s. 1d. per 1000 cubic feet from the present reading of the meter indices. From this figure discounts will be allowed, reducing the charges to an average price of 2s. 10d.

Protection.—Says "Dagonet" in "Mustard and Cress": "Half the Radical Party are really in favour of a scientific tariff, and the other half are rabid Protectionists, like Sir John Brunner and Sir Alfred Mond—where their own business is concerned." Has "Dagonet" heard of the recent tussle in Parliament between the chemical manufacturers and the gas industry?

Heating in the Future.—In the course of an interview with the representative of the "Liverpool Daily Post and Mercury" on the subject of the abatement of smoke, Professor W. H. Watkinson, of the Faculty of Engineering at the Liverpool University, made the following remarks: "For domestic heating, the best solution [of the smoke problem] would be the use of gas-fires. Since the gas companies undertook to supply these fires at a lower rate, which included fitting and maintenance, the demand for them has shown a very decided advance. What is wanted is a vigorous campaign to bring the advantages to the knowledge of the masses. Under proper conditions, the annual cost will not be materially different from, it might even be less than, the cost of the consumption of coal. . . . In Liverpool, the atmosphere cannot be a pure one until the coal-fire is a thing of the past; and probably that time is not so distant as might be assumed."

Stafford Gas Undertaking.

The annual dinner of the Stafford Corporation Gas and Electricity Department took place on Saturday, the 4th inst.—Mr. W. M. Valon, the Engineer of the Gas Department, presiding. In proposing the toast of "The Gas and Electricity Committee," he referred to the announcement that Mr. C. H. Wright, the Chairman of the Committee, intended to resign his seat on the Town Council in November, and expressed a hope that he would reconsider his decision. Mr. Wright, in responding, stated that when the Corporation acquired the gas-works in 1876, the output of gas was 55 million cubic feet. This year it would be 220 millions. He had been a member of the Council for thirty-one years; and though he should be sorry to leave the Gas Department, he should be obliged to retire next November. In proposing "The Health of the Staff," the Chairman said reference had been made to the fact that the gas-works had given £3500 a year in relief of the rates. This would not always be so. Parliament, during the last two years, had made up their minds that municipally-owned undertakings worked for a profit should be run for the good of the people; and their idea of the "people" was those who used the product. Parliament had said that not more than a certain percentage of the profits should be paid in aid of the rates, and that the price of gas must be reduced. If the Stafford Corporation were now to go to Parliament for powers, the result would be that instead of giving £3500 a year in aid of rates the sum would be £384. If this were done, they would be able to reduce the price of gas by 6d. per 1000 cubic feet; and it was a debateable point which was the better course to adopt. In about ten years' time, the existing debt on the works would have been repaid. This would enable them to further reduce the price of gas; so that they had a good chance of selling gas at the cheapest rate in the country.

York City Council and the Gas-Works.—At the last meeting of the York City Council, a motion was proposed by Alderman S. W. Meyer approving of the promotion of the Bill by which the Corporation seek power to acquire the undertaking of the York Gas Company and for other purposes. Alderman Wragge moved an amendment that the part of the Bill referring to the gas undertaking should be withdrawn. He said the cost of purchasing it would be £569,500; and assuming that they could borrow the money for 45 years, they would require £26,000 annually in repayment of principal and interest. Yet the profits of the Gas Company in 1911 were only £17,644. This would leave a deficit of £8356, which was about equal to a rate of 5d. in the pound to be added to the present rates. Alderman Meyer said the opposition had come too late, as the Council had already agreed to purchase, and it was on this agreement that the Company's Bill was withdrawn last June. For the Council now to repudiate the agreement would be very dishonourable. On being put to the vote, the amendment was defeated by 30 votes to 11; the original motion being carried by 31 to 12.

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INCLUDING **8** REPEAT ORDERS.

LATEST ORDERS.

MOSCOW	**216**	**RETORTS.**
ANTWERP	**108**	,,
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Proposed Purchase of the Suffolk Electricity Company.—A sparsely attended meeting of the shareholders in the Suffolk Electricity Supply Company, of Stowmarket, Felixstowe, and Diss, was held at Ipswich on Friday, to consider the granting of an option to Dr. Leibbrand in connection with a proposal for the purchase of the concern by a new Company, in which, if they so desire, the present shareholders will retain their interest. After considerable discussion, it was decided to grant Dr. Leibbrand the option to purchase in the terms of the agreement.

The Supply of Gas to Shaldon.—It was reported at the monthly meeting of the Teignmouth Town Council last week that the question of the supply of gas to Shaldon had been further considered at a private meeting of the Council. The draft of an agreement with the Teignmouth and Shaldon Bridge Company for the carrying of a main across the bridge was laid before the meeting, and it was resolved to inform the Company that the Council were provisionally prepared to pay £20 per annum, to include wayleave and the supply of the necessary lamps. The Chairman said he understood that a possible site for a gasholder had been found at Shaldon.

Complaints of Defective Electric Lighting.—According to the "Newquay Express," the streets of that holiday resort are very badly lighted. Occasionally, it is said, whole streets are left in darkness. The matter has been frequently before the District Council, and urgent representations have been made to the Electric Lighting Company. But the same thing recurs, and people are beginning to wonder whether things will ever be better. The newspaper remarks that the electric lighting is a great improvement upon the old gas lighting, but adds somewhat illogically that the electric light is so unreliable that no one knows whether a street may not be left in total darkness. In some cases individual lamps have remained unlighted for two or three days, while others have been burning day and night. The "Express" considers it lucky that there has been no serious accident, and suggests that if one should occur the authorities may find themselves liable for heavy damages.

Oldbury Gas-Works.—Last Thursday afternoon, the members of the Birmingham and District Library Association paid a visit to the Oldbury Gas-Works, where the Manager (Mr. Adam Cooke) lucidly explained the process of gas making. The water-gas plant, which had not been utilized for some little time, was specially set working for the benefit of the visitors, who at the close of the inspection accorded Mr. Cooke a hearty vote of thanks. The new gasholder, which is now in course of erection at the works, and which will cost about £9000, will not be completed until April or May next; the delay having been occasioned through a very bad foundation, which has necessitated the putting in of about 17 feet of concrete. The whole of the cost of the holder will be defrayed out of revenue. It is a pleasing fact that no loan has been required for the gas-works for over twenty years; and during this time the works have been practically rebuilt. Then the price charged for lighting and power purposes is as low as, or lower than, that in any town of its size in the country.

Costs of the Ivybridge Water Bill.—A statement of the cost of promoting the Bill passed for the provision of a new water supply was laid before the Ivybridge District Council last Tuesday. The total amount was £1783. As only five years are allowed to pay off this sum, £420 a year will be required for principal and interest; and this will necessitate a rate of about 1s. 7d. in the pound for five years.

Gas Explosions at Lisburn.—The officials of the Lisburn Gas-Works, on the evening of the 4th inst., failed to locate an escape of gas, which caused a good deal of uneasiness in the neighbourhood of Canal Street, and before anything could be done a violent explosion occurred; the heavy metal top of a manhole being hurled into the air, a gully trap carried over a house, and others raised in the yards of houses, while a girl passing along the street was blown to the other side. Much damage was done to two houses in the vicinity, neither of which was connected with the gas-main. The assumption is an escape of gas into the sewer led to the explosion.

Gas Companies and the Right to Open Roads.—The Daventry Rural District Council have received a copy of the United District Gas Company's Bill, which was noticed in the "JOURNAL" last week (p. 29). The Clerk (Mr. J. D. Spearing) stated that he had pointed out to the Parliamentary Agents for the Bill (Messrs. Lees and Co.) that the Council had an agreement with the Bucks and Oxon Gas Company; and, in return for permission to break up the road at Byfield and Woodford Halse, the Company undertook to provide gas at the lowest price paid by consumers, and to find the standards for public lighting. He had asked the Agents if they would be willing to insert a similar clause, and they had replied that as the Company was a public one the Council would have power to go to arbitration as regards price. They thought the clause was unusual and not necessary. It was resolved to press for the insertion of a clause.

Dehydration of Tar in Small Gas-Works.—It may be remembered that, in the course of his evidence before the Joint Committee on Residual Products, Mr. Maybury, the Kent County Surveyor, suggested that the small gas companies should be encouraged to combine to put down dehydrating plant for the production of tar cheaply for road purposes. The "Sanitary Record," referring to this suggestion, said: "Dehydration is much less satisfactory than distillation; and, on economic grounds, it is not to be commended, inasmuch as the recovery of the valuable bye-products which are utilized for the manufacture of disinfectants, dyes, patent medicines, and numerous other compounds, as now carried out, would be impracticable, and would be diverted to our German competitors. Moreover, if every small gas-works in the country were to establish dehydrating plants, we should revert back to the loose methods of purchasing a material of which no guarantee could be secured as to a standard of quality—a practice which obtained when crude tar was applied for road work, and with so many failures; for small gas-works cannot, and do not, employ men qualified to carry out the necessary analyses. Simple dehydration is not nearly so efficient as scientific distillation, which is carried out by firms of specialists."

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Price of Coke at Mossley.—Coke consumers in the Mossley and Saddleworth districts, feeling aggrieved at the continued high price of coke at the gas-works—viz., 9d. per cwt.—appointed a deputation to wait upon the Gas Committee of the Mossley Corporation with a view to securing a reduction. At the conclusion of the interview, the members of the deputation were informed that gas making was a commercial undertaking, and the Gas Committee were bound to obtain the best prices possible in the public interest. It was also pointed out that the advance in the price for coal materially affected the position.

Birkenhead Corporation Water Scheme—It was reported at a meeting of the Birkenhead Corporation last Wednesday, that the Board of Trade had sanctioned the amended scheme for the aqueduct in connection with the water-works at Alwen, North Wales, so as to carry the pipe-line under the navigable part of the Dee by means of a tunnel, to cost £10,500. The Engineers for the scheme (Sir Alex. Binnie, Son, and Deacon) submitted to a special meeting of the Water Committee drawings, specification, and bills of quantities for the construction of the proposed service reservoir, &c., at Wirral, which will receive the water after it has passed the Dee; and it was decided to invite tenders for carrying out the work.

Electricity and Gas at Dromore.—Mr. James Dickson, at a meeting of the Dromore (Co. Down) Urban Council, said that a movement was on foot in the town to oppose a proposed electric light scheme, on the ground that it would be seriously detrimental to the ratepayers; and the Clerk was instructed to circulate a *résumé* of the scheme and the negotiations in regard to it. Mr. Haskins was the mover of a resolution, which was adopted, prohibiting the Gas Company, or any other person, from opening the streets without the authority of the Surveyor or the Clerk, and providing for a guarantee against damage. The Gas Company, Mr. Haskins said, might have a right to open the streets to repair the gas-mains; but they were bound to leave them as they had found them, and there were instances where they had failed to do this. The Clerk's opinion was that a bye-law was required to meet the position that had arisen.

We have received from Messrs. D. Hulett and Co., Limited, of High Holborn, their list No. 159, in which are shown the latest types and patterns of inverted gas arc lamps for indoor and outdoor use, street lamps and columns, lamp-brackets, service cleansers, syphon pumps, gas-meters, patent meter supports, &c. Enclosed in the list is a sheet showing the firm's "Hulo" and other inverted burners for the 1912-13 season, additional patterns of globes, distance lighters, &c.

Among the new joint stock companies lately registered are the following: Interlocked Metallic Tubing Company, Limited, with a capital of £100, in £1 shares; Robinlyte Amalgamated Companies, Limited, with a capital of £30,000, in £1 shares (10,000 each of "A," "B" and "C"), to take over the undertakings of Robinlyte, Limited, and Robinlyte (Foreign Patents), Limited, to acquire patents, &c., and to carry on the business of manufacturers of, and dealers in, incandescent mantles and gas-burners, or machines for manufacturing them, and appliances for use in connection with gas or electric light, &c.

APPLICATIONS FOR LETTERS PATENT.

21.—Valentine, H. S., "Gas-fires." Jan. 1.
57.—Anderson, J., "Gas-meters." Jan. 1.
82.—Heyl, J. E., and Baker, T. T., "Treatment of fluid-fuel to enhance its calorific value and its capability of developing mechanical energy." Jan. 1.
132.—Marks, E. C. R., "Gas-engines." A communication from the Standard Separator Company. Jan. 2.
153.—Bland, C. W., "Inverted burners." Jan. 2.
191.—Slatter, A. F., "Fire-lighter and burner." Jan. 3.
207.—Kilburn, B. E. D., "Compressing apparatus." A communication from F. W. S. Stokes. Jan. 3.
267.—Fletcher, Russell, and Co., Ltd., and Fletcher, T. W., "Gas fires or stoves." Jan. 4.

GAS COMPANIES' STOCK AND SHARE LIST.

The week just closed—the first full week of the New Year—has been a disappointing one for the Stock Exchange. Members had prepared themselves in readiness to rejoice over a renewal of business activity and strong markets; but it did not come. Chief among sinister factors of depression were the doubts and fears regarding the establishment of peace in the Balkans which continue to brood darkly overhead day after day without showing a chink of promising light. This being so, the general watchword has been "Caution." The opening on Monday was very quiet and shy; but gradually a rather better feeling showed itself. Gilt-edged securities were shaky, but Consols did not move. Rails were uneven, though the ups rather outnumbered the downs; and Americans, after much fluctuation, closed better. Tuesday's course was much the same. Consols were unchanged, Rails variable, and Americans moderate. Wednesday plucked up a bit, and some prices advanced, though the best were not maintained up to the close. Consols were steady. Markets in general were not particularly bright on Thursday; but Consols managed an advance of $\frac{1}{8}$. Rails were fluctuating—falls predominating. Americans moved uncertainly. Friday was quite a dull day; and the usual selling was in full swing, owing largely to the Conference *impasse* among a variety of causes. Consols fell $\frac{1}{8}$ for account, and Rails were weaker throughout. Americans gave way, and the Foreign Market was in poor case. Things were a prey to persistent depression on Saturday in most markets; but Consols closed without further change at $75\frac{1}{8}$ to $75\frac{3}{8}$—a gain of $\frac{1}{8}$ in the week. In the Money Market, there was a good steady demand which kept rates firm; but discount was rather inclined to be easier. Business in the Gas Market showed an improvement in point of volume, and prices in general were quite satisfactory. Indeed, in one or two instances an advance in quotation might have been looked for. In Gaslight and Coke issues, the ordinary was pretty active, and prices were at a higher level, ranging from 106 to 107. In the secured issues, nothing was marked in the maximum; but the preference realized from 100 to 102, and the debenture 76 and $76\frac{3}{4}$. South Metropolitan was very little dealt in, and prices were firm at the previous week's figures—117 to $117\frac{1}{2}$. In Commercials, business in the 4 per cent. was marked at $106\frac{1}{2}$ to 108. Among the Suburban and Provincial group, Bournemouth "B" changed hands at $16\frac{1}{8}$, Brentford old at $258\frac{1}{2}$, British at 45, Hastings at 93, South Suburban at $117\frac{1}{4}$ to $119\frac{1}{2}$, and (on the local Exchange) Newcastle and Gateshead at $100\frac{3}{4}$ and 101—a rise of 1. In the Continental companies, Imperial was a point lower at 175 to $176\frac{1}{2}$, ditto debenture was a point higher at $87\frac{1}{4}$ to 88, Union realized $84\frac{1}{2}$ and 86, ditto preference $131\frac{3}{4}$, European $19\frac{3}{8}$, and Tuscan debenture 97 and $97\frac{1}{2}$—a rise of $\frac{1}{2}$. Among the undertakings of the remoter world, Bombay was marked at $6\frac{5}{8}$, Cape Town debentures at 73, Hongkong at $16\frac{1}{8}$ and $16\frac{3}{8}$, Primitiva at $6\frac{7}{16}$ to $6\frac{5}{8}$, and ditto preference at $5\frac{7}{16}$ to $5\frac{3}{16}$.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,868	Stk.	Oct. 11	5	Alliance & Dublin Ord.	73—78	..	6 8 2
374,000	,,	July 12	4	Do. 4 p.c. Deb.	83—86	..	4 13 0
250,000	5	Oct. 11	7½	Bombay, Ltd.	6½—7	..	5 7 2
50,000	10	Aug. 29	15	Bourne-mouth Gas & Water	10 p.c. . . B 7 p.c. . . Pref. 6 p.c.	..	29—30 .. 5 0 0 15⅝—16½ .. 4 6 2 14—14½ .. 4 2 9
332,000	10	,,	7				
75,000	10	,,	6				
380,000	Stk.	Aug. 14	13½	Brentford Consolidated	257—262	..	5 3 1
330,000	,,	,,	10½	Do. New	198—203	..	5 3 5
50,000	,,	,,	5	Do. 5 p.c. Pref.	116—118	..	4 4 9
206,250	,,	Dec. 12	4	Do. 4 p.c. Deb.	94—96	..	4 3 4
218,230	Stk.	Aug. 29	11	Brighton & Hove Orig.	210—215	..	5 2 4
244,200	,,	,,	8	Do. A Ord. Stk.	152—155	..	5 3 3
530,000	20	Sept. 27	12½	British	44½—45½	..	5 9 11
120,000	Stk.	Dec. 30	4	Do. 4 p.c. Deb. Stk.	89—91*	..	4 7 11
245,771	Stk.		4	Buenos Ayres 4 p.c. Deb.	92—94*	..	4 5 1
100,000	10	,,	—	Cape Town & Dis., Ltd.	2—3	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	3½—4½	..	—
100,000	Stk.	Dec. 30	4½	Do. 4½ p.c. Deb. Stk.	71—75*	..	6 0 0
157,150	Stk.	Aug. 29	5	Chester 5 p.c. Ord.	110—112	..	4 9 3
1,513,380	Stk.	Aug. 29	5/9/4	Commercial 4 p.c. Pref.	106—108	..	5 1 2
560,000	,,	,,	5½	Do. 3½ p.c. do.	102—104	..	5 2 6
475,000	,,	Dec. 12	3	Do. 3 p.c. Deb. Stk.	71—73	..	4 2 2
800,000	Stk.	,,	4	Continental Union, Ltd.	83—86	..	4 13 0
200,000	,,	,,	7	Do. 7 p.c. Pref.	130—132	..	5 6 1
492,370	Stk.	—	5½	Derby Con. Stk.	124—126	..	4 12 0
65,000	,,	—	4	Do. Deb. Stk.	103—105	..	3 16 2
1,002,180	10	July 26	10	European, Ltd.	19—20	..	5 0 0
16,160,600	Stk.	Aug. 14	4/17/4	Gas	4 p.c. Ord.	..	105—107 .. 4 11 0
2,600,000	,,	,,	3½	light and Coke	3½ p.c. max.	..	82—85 .. 4 2 4
4,052,235	,,	,,	4		4 p.c. Con. Pref.	..	100—102 .. 3 18 5
4,631,705	,,	Dec. 12	3		3 p.c. Con. Deb.	..	75—77 .. 3 17 11
258,740	Stk.	Sept. 13	5	Hastings & St. L.	3½ p.c.	..	91—93 .. 5 7 6
82,500	,,	,,	6½	Do.	do. 5 p.c.	..	— .. —
70,000	10	Oct. 11	11	Hongkong & China, Ltd.		..	16—16⅛ .. 6 13 4
131,000	Stk.	Sept. 13	7⅛	Ilford A and C		..	154—157 .. 4 17 1
65,780	,,	,,	6½	Do. B		..	121—123 .. 4 19 7
65,500	,,	Dec. 30	4	Do. 4 p.c. Deb.		..	89—91* .. 4 7 11
4,940,000	Stk.	Nov. 14	9	Imperial Continental		..	173—178 —1 5 1 1
1,235,000	Stk.	Aug. 14	8¼	Do. 3½ p.c. Deb. Red.		..	87—89 +1 3 18 8
200,942	Stk.	Aug. 29	6	Lea Bridge Ord. 5 p.c.		..	122—125 .. 4 16 0
561,000	Stk.	Aug. 29	10	Liverpool United A		..	223—225 .. 4 8 11
718,100	,,	,,	7	Do. B		..	161—163 .. 4 5 11
806,083	,,	Dec. 30	4	Do. Deb. Stk.		..	98—100* .. 4 0 0
63,480	Stk.	June 28	3	Maidstone 3 p.c. Deb.		..	69—71 .. 4 4 6
75,000	5	Nov. 28	6	Malta & Mediterranean		..	4⅛—4⅝ .. 6 6 4
250,000	100	Oct. 1	4½	Met. of Melbourne	4½ p.c. Deb.	..	99—101 .. 4 9 1
541,930	20	Oct. 30	3½	Monte Video, Ltd.		..	12—12½ .. 5 12 0
1,775,892	Stk.	July 26	4½	Newc'tle&G'tesh'd Con.		..	100½—101½ +1 4 6 2
529,705	Stk.	Dec. 30	3½	Do. 3½ p.c. Deb.		..	85½—86½* .. 4 0 11
55,940	10	Aug. 29	7/7/0	North Middlesex 7 p.c.		..	13½—14½ .. 5 1 5
800,000	Stk.	Nov. 28	8	Oriental, Ltd.		..	125—130 .. 6 3 1
60,000	5	Sept. 27	10	Ottoman, Ltd.		..	8⅛—8⅜ .. 5 14 3
60,000	50	Aug. 14	13	Portsea, Island B		..	127—130 .. 5 0 0
100,000	50	,,	12	Do. C		..	124—127 .. 4 14 6
249,980	5	Oct. 11	8	Primitiva Ord.		..	6⅛—6⅝ .. 5 18 6
499,960	5	Dec. 30	5	,, 5 p.c. Pref.		..	5—5½* .. 4 15 3
521,600	100	Dec. 2	4	,, 4 p.c. Deb.		..	96—98 .. 4 1 8
346,198	Stk.	Dec. 30	4	River Plate 4 p.c. Deb.		..	92—94* .. 4 5 1
275,000	5	Apl. 12	12	San Paulo, Ltd.		..	13—14 .. 4 5 9
150,000	10	Sept. 27	6	Do. 6 p.c. Pref.		..	11½—12 .. 5 0 0
125,000	50	Jan. 2	5	Do. 5 p.c. Deb.		..	49—51* +1 4 18 0
135,000	Stk.	Aug. 29	10	Sheffield A		..	231—233 .. 4 5 10
209,984	,,	,,	10	Do. B		..	230—232 .. 4 6 2
538,500	,,	,,	10	Do. C		..	229—231 .. 4 6 7
90,000	10	Sept. 27	7½	South African		..	9⅛—10⅛ .. 7 2 10
6,429,895	Stk.	Aug. 29	5/9/4	South Met., 4 p.c. Ord.		..	116—118 .. 4 12 8
1,895,445	,,	July 12	3	Do. 3 p.c. Deb.		..	76—79 .. 3 15 11
209,820	Stk.	Aug. 14	8½	South Shields Con. Stk.		..	164—166 +1 5 2 5
605,000	Stk.	Aug. 14	5/16/8	S'th Suburb'n Ord. 5 p.c.		..	118—121 —½ 4 16 3
60,000	,,	,,	5	Do. 5 p.c. Pref.		..	117—119 .. 4 4 0
117,058	,,	Dec. 30	5	Do. 5 p.c. Deb. Stk.		..	118—120* .. 4 3 4
594,740	Stk.	Nov. 14	5	Southampton Ord.		..	102—105 .. 4 15 3
120,000	Stk.	Aug. 14	7½	Tottenham and	A 5 p.c. . . B 3½ p.c. . .	..	142—145 .. 5 0 0 115—117 .. 4 18 3
483,940	,,	,,	5½				
149,470	,,	Dec. 30	4	Edmonton	4 p.c. Deb.	..	92—94* .. 4 5 1
182,380	10	,,	5	Tuscan, Ltd.		..	8—8⅜* .. 5 17 8
149,900	10	Jan. 2	5	Do. 5 p.c. Deb. Red.		..	96—98* +½ 5 2 0
236,476	Stk.	Aug. 14	5	Tynemouth, 5 p.c. max.		..	115—115½ .. 4 6 7
255,636	Stk.	Aug. 29	6⅔	Wands-worth	B 3½ p.c. . . 3 p.c. Deb. Stk.	..	139—142 .. 4 16 10 68—70* .. 4 5 9
85,766	,,	Dec. 30	3				

Prices Marked * are "Ex. Div."

The fusing of a wire in connection with one of the electroliers at Carrington Church, Nottingham, shortly after the congregation had dispersed on the evening of the 5th inst., caused considerable alarm. On the arrival of the Fire Brigade, it was found that the insulating material was burning. The current was switched off and the fire extinguished—fortunately before much damage was done.

The Birkenhead Corporation have accepted the tender of Messrs. Stewarts and Lloyds, Limited, for the provision of a 10-inch high-pressure main from the central gas-works to the new holder station in course of construction—a distance of about 3200 yards. The tender of B. Gibbons, jun., Limited, of Dudley, for the supply of retorts, fire-bricks, fire-clay, and fire-clay blocks has also been accepted.

A return just published by the London County Council shows the cost of municipal services in London and county boroughs in England and Wales having a population of more than 100,000. The figures relate to 1908-9, and the cost has been reduced to the amount per head of population and per pound of assessable value. Comparing London with the six largest provincial towns, it is shown that while the total cost per head of population is highest in London, the total cost per pound of assessable value is lowest. The figures are: Cost per head of the population—London, 63s. 9 5d.; average of six boroughs, 46s. 8·7d. Cost per pound of assessable value—London, 6s. 5·9d.; average of six boroughs, 8s. 4·2d.

We have to acknowledge the receipt of calendars from Messrs. Peckett and Sons, of Bristol, Messrs. Bleichert's Aerial Transporters, Limited, of London, Messrs. Brotherton and Co., of Leeds, Messrs. J. Taylor and Co., of Bolton, the Wholesale Fittings Company, of Commercial Street, E., and the Wigan Coal and Iron Company, of Birmingham; and of a blotting-pad from Messrs. Mobberley and Perry, of Stourbridge.

The staff of the Leeds branch of Messrs. James Milne and Son, Limited, were, by the invitation of the Director and Manager (Mr. William D. Helps), entertained at dinner last Friday evening at the Métropole Hotel, Leeds. After the toast of "The King" had been duly honoured, "The Health of the Host" (the only other toast) was ably proposed by Mr. Sykes Brook, and supported by Mr. J. M. Greenwood, foreman of the meter and brass works. Mr. Helps, in response, referred to many interesting matters, not the least being the fact that the branch at Leeds was only started in July, 1893, and yet the staff now averaged some 13½ years' service each. In addition to this, he reminded his guests that, though the branch had been established so recently, there was evidence, from an old letter-book which had been discovered at Edinburgh, that Mr. John Milne, the founder of the firm, visited Leeds as far back as 1819, and booked orders for gas apparatus from the Leeds Gas Company. The proceedings were pleasantly interspersed with songs and recitations.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

ASSISTANT WATER ENGINEER. Borough of Richmond (Surrey). Applications by Jan. 27.
COLLECTOR. Wolverhampton Gas Company.
DRAUGHTSMAN. R. & J. Dempster, Limited, Manchester.
DRAUGHTSMAN. Gibbons Bros., Dudley.
GAS FITTERS. Rushden and Higham Ferrers Gas Company.
MECHANIC. No. 5684.
OUTDOOR INSPECTOR. Aberdare and Aberaman Gas Company.
SLOT COLLECTOR AND MAINTENANCE. Pembroke Dock Gas Company.

Appointments, &c., Wanted.

LEADBURNER AND CHEMICAL PLUMBER. No. 5673.
ASSISTANT OR WORKS MANAGER. No. 5682.

Plant (Second-Hand), for Sale.

CENTRE VALVE FOR PURIFIERS. Devizes Gas-Works.
LOCOMOTIVE STEAM CRANE, &c. Lancaster Gas Department.

Plant, &c. (Second-Hand), Wanted.

CONDENSERS AND WASHER. Sittingbourne Gas Company.

Books (Second-Hand) for Sale. No. 5685.

Patent Licence, &c.

DISTILLING AND COKING COAL. Marks and Clerk, Lincoln's Inn Fields, W.C.

Stocks and Shares.

DORKING GAS COMPANY. By Auction. London Mart. Jan. 21.
GREAT YARMOUTH WATER COMPANY. By Auction. London Mart, Jan. 21.
SHERINGHAM GAS AND WATER COMPANY. By Auction. London Mart. Jan. 21.
SOUTH WEST SUBURBAN WATER COMPANY. By Auction. London Mart. Jan. 21.
SOUTHEND WATER COMPANY. By Auction. London Mart. Jan. 21.

TENDERS FOR

Coke Breeze.

SWANSEA GASLIGHT COMPANY.

Condenser.

WARRINGTON GAS DEPARTMENT.

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A HISTORY OF THE

INTRODUCTION OF GAS LIGHTING.

BY CHARLES HUNT, M.Inst.C.E.,

Past-President of the Institution of Gas Engineers. Author of "Gas Lighting," which forms the Third Volume of Groves and Thorpe's "Chemical Technology."

As a frontispiece, the book has a photographic reproduction of the portrait of William Murdoch in the Edinburgh Art Gallery. There are also portraits of the Hon. Robert Boyle, F.R.S., James Watt, Philippe Lebon, Frederick Albert Winsor, &c.; a reproduction of the picture of "Scientific Celebrities in 1800," in the National Portrait Gallery, in which James Watt, Boulton, and Wm. Murdoch are included; and numerous illustrations of various apparatus used in the early Manufacture of Gas, with three folding plates, reproduced from the original drawings of Messrs. Phillips and Lee's Mill and the Gas-Works erected there in 1806. In addition to these, there are also views of Bello Mills Cottage, the birthplace of Murdoch, and of the neighbourhood in and around Lugar.

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See Illustrated Advertisement, Dec. 17, p 933.

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Applications, on Forms to be obtained from the undersigned, together with *copies* of Three recent Testimonials, must reach the Town Clerk on or before Monday, the 27th day of January, 1913.
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Jan. 7, 1913.

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Manager and Secretary.

WANTED, by the Rushden and Higham Ferrers District Gas Company, a First-Class all-round GAS-FITTER, thoroughly experienced in Slot Work, Fixing Meters, Cookers, Gas-Fires, &c. Total Abstainer Preferred. Pemanency to a suitable Man. 56½ Hours per Week, Wages 7½d. per Hour.
Apply, by letter, stating Age, Experience, &c., with References, to the MANAGER, Gas-Works, Rushden, NORTHANTS.

WANTED, by the Rushden and Higham Ferrers District Gas Company, a Smart Young GAS-FITTER of Good Appearance for Maintenance Work, but Capable and Willing to do other Classes of Gas-Fitting Work if required. Total Abstainer Preferred. Permanency to a suitable Man. 56½ Hours per Week, Wages 6d. per Hour.
Apply, by letter, stating Age, Experience, &c., with References to the MANAGER, Gas-Works, Rushden, NORTHANTS.

MECHANIC wanted for Gas-Works in Scotland for general repairs, with knowledge of Electrical Stoking Plant. Permanent Situation to Suitable Man. Wages, 35s. per week of fifty-one hours.
Apply, by letter, with References, to No. 5684, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.